Volume 3

CityofRedmond
WASHINGTON

Specifications, Proposal and Contract Documents

for

Redmond Central Connector Phase II

Project No. 20021314

Federal Aid No. CM1065(011)

January 2016

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STATE OF WASHINGTON
30792
REGISTERED
PROFESSIONAL ENGINEER
1/14/16

TOUTA J. PHENGSAVATH
STATE OF WASHINGTON
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Nico M. Vanderhorst, P.E.

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Appendix E — Environmental Permits and Information

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DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

JUL 28 2015

Otak, Inc.
AUG - 3 2015
RECEIVED

REPLY TO
ATTENTION OF

Regulatory Branch

Mr. Mike Haley
City of Redmond
Public Works Department
15670 Northeast 85th Street
Redmond, Washington 98073-9710

Reference: NWS-2015-0185
Redmond, City of

Dear Mr. Haley:

We have reviewed your application to construct 1.3 miles of pedestrian trail as Phase 2 of the Redmond Central Connector by filling 0.033 of an acre of wetlands, filling 0.0344 of an acre of Willows Creek, and repairing two bridges over the Sammamish River at Redmond, Washington. Based on the information you provided to us, Nationwide Permit (NWP) 23, *Approved Categorical Exclusions* (Federal Register February 21, 2012, Vol. 77, No. 34), authorizes your proposal as depicted on the enclosed drawings dated October 2014.

In order for this authorization to be valid, you must ensure the work is performed in accordance with the enclosed *NWP23, Terms and Conditions* and the following special conditions:

a. You must implement and abide by the Endangered Species Act (ESA) requirements and/or agreements set forth in the *Biological Assessment: Redmond Central Connector, Phase II*, dated January 15, 2015, in their entirety. The U.S. Army Corps of Engineers (Corps) made a determination of No Effect for all species and critical habitat based on this document. Failure to comply with the commitments made in this document constitutes non-compliance with the ESA and your Corps permit.

b. You shall implement and abide by the *Redmond Central Connector Phase II In Lieu Fee Use Plan* date June 15, 2015, and obtain 1.8635 In Lieu Fee credits in accordance with *Appendix B – Wetland Debit Documents and Scoring Forms.*

c. You shall obtain from the King County Mitigation Reserve Program In Lieu Fee sponsor, documentation of the completed ILF transaction in the form of a Statement of Sale. You shall submit to the U.S. Army Corps of Engineers, Seattle District, Regulatory Branch a

copy of the ILF Statement of Sale prior to performing work in waters of the U.S. authorized by this permit. All submittals must prominently display the reference number NWS-2015-0185.

d. Your responsibility to obtain the required ILF mitigation credits as set forth in Special Condition "b" will not be considered fulfilled until you have received written verification from the U.S. Army Corps of Engineers.

The U.S. Federal Highways Administration (FHWA) completed no effect determinations for the National Historic Preservation Act, Section 7 of the Endangered Species Act (ESA), and Magnuson Stevens Act essential fish habitat (EFH) for its involvement in the proposed activity. For the purpose of this Department of the Army authorization, we have determined this project will comply with the requirements of these laws provided you comply with all of the permit general conditions. We have determined the permit action is sufficiently addressed in their ESA and EFH consultation documents. By this letter we are advising you and the Services, in accordance with 50 CFR 402.07 and 50 CFR 600.920(b), that this agency has served as the lead Federal agency for the ESA and EFH consultation responsibilities for the activity described above.

As part of our permit application review process, we notified Native American tribes that have an interest in this area. In the response memo titled *Redmond Central Connector Phase II – Otak Project No. 32246 USACE Reference No. NWS-2015-0185 – MIT Responses* dated April 23, 2015, you agreed to the Muckleshoot Indian Tribe's request to provide 1) An Operations and Maintenance (O&M) Manual for future bridge operations, and 2) Copies of 'as-built' drawings for mitigation sites as well as all mitigation monitoring reports. Please contact Ms. Karen Walter at (253) 876-3116 prior to commencing construction to arrange how this information will be provided.

The authorized work complies with the Washington State Department of Ecology's (Ecology) Water Quality Certification and the Coastal Zone Management Act requirements for this NWP. No further coordination with Ecology is required.

We have prepared and enclosed a *Preliminary Jurisdictional Determination* (JD) dated April 24, 2015, which is a written indication that wetlands and waterways within your project area may be waters of the U.S. Such waters will be treated as jurisdictional waters of the U.S. for purposes of computation of impact area and compensatory mitigation requirements associated with your permit application. If you believe the Preliminary JD is inaccurate, you may request an Approved JD, which is an official determination regarding the presence or absence of waters of the U.S. If one is requested, please be aware that we may require the submittal of additional information to complete an approved JD and work authorized in this letter may <u>not</u> occur until the approved JD has been finalized.

Our verification of this NWP authorization is valid until March 18, 2017, unless the NWP is modified, reissued, or revoked prior to that date. If the authorized work has not been completed by that date and you have commenced or are under contract to commence this activity before March 18, 2017, you will have until March 18, 2018, to complete the activity under the enclosed terms and conditions of this NWP. Failure to comply with all terms and conditions of this NWP verification invalidates this authorization and could result in a violation of Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act. You must also obtain all local, State, and other Federal permits that apply to this project.

Upon completing the authorized work, you must fill out and return the enclosed *Certificate of Compliance with Department of the Army Permit* form. Thank you for your cooperation during the permitting process. We are interested in your experience with our Regulatory Program and encourage you to complete a customer service survey form. This form and information about our program is available on our website at www.nws.usace.army.mil select "Regulatory Branch, Permit Information" and then "Contact Us." A copy of this letter with or without enclosures will be furnished to Mr. Kevin O'Brien of Otak, Inc. at 11241 Willows Road Northeast, Suite 200, Redmond, Washington 98052. If you have any questions, please contact me at kaitlyn.r.white@usace.army.mil or (206) 316-3156.

Sincerely,

Pamela Sanguinetti

For: Kaitlyn R. White, Project Manager
Regulatory Branch

Enclosures

HYDRAULIC PROJECT APPROVAL

Washington Department of
Fish & Wildlife
PO Box 43234
Olympia, WA 98504-3234
(360) 902-2200

Issued Date: June 12, 2015
Project End Date: December 31, 2016

Permit Number: 2015-4-399+01
FPA/Public Notice Number: N/A
Application ID: 1760

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
City of Redmond Public Works	Otak, Inc.
ATTENTION: Mike Haley	ATTENTION: Kevin O'Brien
15670 NE 85th Street, P.O. Box 97010	11241 Willows Road NE, Ste 200
Redmond, WA 98073	Redmond, WA 98052

Project Name: Redmond Central Connector Trail Phase II

Project Description: The proposed trail will be located along the former Burlington Northern Santa Fe (BNSF) Railway corridor, and will be approximately 1.3 miles in length. The trail will be 17 feet wide and will consist of 12 feet of pavement with 2- and 3-foot-wide gravel shoulders. The proposed RCC Phase II is designed to connect to the Phase 1 trail project to the south, which was recently constructed. In its entirety, the RCC Trail will connect the Willows and Grass Lawn neighborhoods to downtown Redmond and the east end of the Bear Creek Trail. This project will therefore provide a critical link for pedestrian and bicyclists and encourage economic activity in downtown Redmond, and will also provide access to regional trails including the Puget Sound Energy Trail and the Sammamish River Trail.

The project will also retrofit two existing bridges, providing a non-motorized option over both the Sammamish River and 154th Avenue NE. Bridge retrofit measures for the Sammamish River Trestle will include replacement or repair of select timber members with advanced deterioration as well as the installation of new concrete decking and new railings. The bridge over 154th Avenue NE will receive paved asphalt surfacing and new railings on each side.

Where the proposed trail impacts existing sidewalk ramps, the existing ramps and pedestrian signals will be upgraded to meet current ADA standards. Lighting will be installed to provide safety elements to trail users and furnishings and amenities will be provided at select locations throughout the proposed alignment.

The proposed trail has several street and driveway crossings as well as several culvert crossings. All portions of the trail outside of roadway crossings are categorized as non-pollution-generating impervious surfaces because the trail is intended for use by non-vehicular traffic, except for the occasional maintenance and emergency vehicles. Flow control for the new impervious area will be provided through facilities following the RCC trail alignment and utilize on-site mitigation techniques, primarily infiltration. The stream culvert crossing under the existing railroad alignment at Willows Creek will be replaced with a larger culvert that meets WDFW fish-passage requirements.

Mitigation will include invasive species management and native plantings as described in the Wetland and Buffer Mitigation Report and Planting Plans.

PROVISIONS

1. This STANDARD Hydraulic Project Approval (HPA) is issued for:

a) Replacement of two side-by-side existing 24-inch concrete culverts with one 25-foot long by 12-foot-wide stream simulation culvert at Willows Creek (a tributary to the Sammamish River);
b) Modification of the existing Sammamish River Trestle, including replacement of existing timber cross ties and steel tracks with a pre-cast concrete deck and replacement of numerous timber stringers, timber pile caps, and timber cross bracing with new treated timber members of the same size and dimensions;
c) Temporary and permanent wetland, wetland buffer, and stream buffer impacts, including 233 square feet of permanent impacts to Wetland M, associated with Peters Creek, a tributary to the Sammamish River; and
d) Implementation of the Redmond Central Connector Phase II Wetland and Buffer Mitigation Plan, including invasive species control and native vegetation plantings.

Note: The project includes locations on the Sammamish River, Willows Creek, and Wetland M, which is associated with Peters Creek. The Sammamish River supports chinook, coho, sockeye, steelhead, and kokanee salmon. Willows Creek supports spawning and rearing by coho salmon with the potential to support other salmon species downstream. Peters Creek supports spawning coho salmon and has the potential to support other salmon species.

2. TIMING LIMITATIONS: The project may begin immediately and shall be completed by December 31, 2016, PROVIDED:
a) All work below the ordinary high water line (OHWL) of the Sammamish River (including installation of temporary falsework and driven steel piles to support existing steel girders) shall occur between July 16 and August 31 of calendar years 2015 and 2016;
b) All work below the OHWL of Willows Creek (including removal of two existing culverts and installation of a new stream simulation culvert) shall occur between July 1 and September 30 of calendar years 2015 and 2016; and
c) All impacts to Wetland M shall occur between July 1 and September 30 of calendar years 2015 and 2016.

3. NOTIFICATION AND PHOTOGRAPH REQUIREMENT: The Habitat Biologist listed below shall receive written notification (email, FAX, or mail) from the person to whom this HPA is issued (permittee) or the agent/contractor no less than three working days prior to the start of work, and again within seven days of the completion of work to arrange for a compliance inspection. The notification shall include the permittee's name, project location, starting date for work or completion date of work, and the permit number for this HPA. Photographs of this project shall be taken showing the site before work begins and after work is complete. Photos and all notifications shall be uploaded online to the Aquatic Protection Permitting System (APPS) under Post Permit Requirements (for written notification) and Supporting Documents (for photographs), and emailed to the Habitat Biologist (Angie.Peace@dfw.wa.gov).

4. POST-CONSTRUCTION NOTIFICATION REQUIREMENT: The permittee, agent or contractor shall contact the Washington Department of Fish and Wildlife by e-mail to HPAapplications@dfw.wa.gov; mail to Post Office Box 43234, Olympia, Washington 98501-1091; or fax to (360) 902-2946 within seven days of completion of the work. The notification shall include the permittee’s name, project location, completion date for the work, and the HPA permit number. The department may conduct a compliance inspection; however, the department will notify the permittee or agent prior to the inspection.

5. APPROVED PLANS: Work shall be accomplished per plans and specifications approved by the Washington Department of Fish and Wildlife (WDFW) entitled "Redmond Central Connector Phase II" dated October 20, 2014 and revised April 20, 2015; and all supporting documents and communications uploaded to the APPS project file, including Technical Memorandums received April 21 and June 9, 2015; except as modified by this HPA. A copy of these plans shall be available on site during construction.

6. INVASIVE SPECIES: To prevent the spread of invasive species, all gear and equipment used on site (including equipment, hand tools, boots, waders, etc.) shall be thoroughly cleaned before arriving and leaving the project area. Any water and/or chemicals used to clean gear and equipment shall be properly disposed of. Additional information can be found in WDFW's Invasive Species Management Protocols (November 2012), available online at http://wdfw.wa.gov/publications/01490/wdfw01490.pdf.

7. FISH KILL/WATER QUALITY NOTIFICATION: If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate

notification shall be made to the Washington Military Department's Emergency Management Division at 1-800-258-5990, and to the Habitat Biologist listed below.

WATER QUALITY RELATED

8. All treated wood shall be professionally treated and completely cured prior to installation below the ordinary high water line to minimize leaching into the water or substrate. The use of wood treated with creosote or pentachlorophenol is not authorized.

9. All lumber to be used for the project shall meet or exceed the standards established in the most recent version of 'Best Management Practices For the Use of Treated Wood in Aquatic and Wetland Environments' developed by the Western Wood Preservers Institute, Wood Preservation Canada, Southern Pressure Treaters' Association, and Southern Forest Products Association. As of April 2015, the latest version is dated April 3, 2012.

10. Erosion control methods shall be used to prevent silt-laden water from entering the stream. These may include, but are not limited to, straw bales, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas.

11. Wastewater from project activities and water removed from within the work area shall be routed to an area landward of the ordinary high water line to allow removal of fine sediment and other contaminants prior to being discharged to the stream.

12. All waste material such as construction debris, silt, excess dirt or overburden resulting from this project shall be deposited above the limits of flood water in an approved upland disposal site.

13. If high flow conditions that may cause siltation are encountered during this project, work shall stop until the flow subsides.

14. Extreme care shall be taken to ensure that no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into the stream.

EQUIPMENT RELATED

15. Equipment used for this project may operate below the ordinary high water line, provided the drive mechanisms (wheels, tracks, tires, etc.) shall not enter or operate below the ordinary high water line.

16. The use of equipment below the ordinary high water line shall be limited to that necessary to gain position for work.

17. Equipment used for this project shall operate stationed on existing disturbed surfaces to the extent possible.

18. Equipment crossings of the stream are not authorized by this HPA.

19. Equipment used for this project shall be free of external petroleum-based products while working around the stream. Accumulation of soils or debris shall be removed from the drive mechanisms (wheels, tires, tracks, etc.) and undercarriage of equipment prior to its working along the stream. Equipment shall be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities along the stream.

SAMMAMISH RIVER BRIDGE REHABILITATION

20. The new bridge deck shall be placed in a manner to minimize damage to the streambed and banks.

21. Abutments, piers, piling, sills, approach fills, etc., shall not constrict the flow and cause any appreciable increase (not to exceed 0.2 feet) in backwater elevation (calculated at the 100-year flood) or channel-wide scour, and shall be aligned to cause the least effect on the hydraulics of the stream.

22. Approach material shall be structurally stable and shall be composed of material that if eroded into the water shall not be detrimental to fish life.

23. Removal of the existing structure shall be accomplished so the structure and associated material does not enter the stream. Material shall be disposed of so it will not re-enter the stream.

24. Containment will be provided below the work areas above the wetted perimeter to catch any construction debris or deleterious materials and prevent them from entering the river.

25. All temporary falsework and associated materials shall be removed upon trestle rehabilitation completion. Temporarily disturbed areas shall be restored to pre-project or improved habitat configuration and revegetated with native woody vegetation. Permanent stream buffer impacts shall be mitigated by enhancing stream buffer areas adjacent to impacted areas as described in the submitted plans.

WILLOWS CREEK BY-PASS

26. A temporary bypass to divert flow around the work area shall be in place prior to initiation of other work in the wetted perimeter. A gravity bypass associated with physical isolation shall be the approved bypass method.

27. A sandbag revetment or similar device shall be installed at the bypass inlet to divert the entire flow through the bypass.

28. A sandbag revetment or similar device shall be installed at the downstream end of the bypass to prevent backwater from entering the work area.

29. The bypass shall be of sufficient size to pass all flows and debris for the duration of the project. Per the Technical Memorandum received June 9, 2015, the gravity bypass will be sized to accomodate a 25-year recurrence event.

30. The permittee shall capture and safely move food fish, game fish, and other fish life from the job site. The permittee shall have fish capture and transportation equipment ready and on the job site. Captured fish shall be immediately and safely transferred to free-flowing water downstream of the project site. Fish will be removed from the isolated area per protocols described in the Regional Road Maintenance, Endangered Species Act Program Guidelines (WSDOT 2002 and 2008 Addendum) and in the Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act (NMFS 2000).

31. Any device used for diverting water from a fish-bearing stream shall be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 77.57.010 and 77.57.070. The pump intake shall be screened by one of the following:
a. Perforated plate: 0.094 inch (maximum opening diameter).
b. Profile bar: 0.069 inch (maximum width opening).
c. Woven wire: 0.087 inch (maximum opening in the narrow direction).
The minimum open area for all types of fish guards is 27%. The screened intake shall consist of a facility with enough surface area to ensure that the velocity through the screen is less than 0.4 feet per second. Screen maintenance shall be adequate to prevent injury or entrapment of juvenile fish and the screen shall remain in place whenever water is withdrawn from the stream through the pump intake.

32. Upon completion of the project, all material used in the temporary bypass shall be removed from the site and the site returned to preproject or improved conditions.

WILLOWS CREEK CULVERT (PERMANENT)

33. The culvert shall be installed and maintained to ensure unimpeded fish passage.

34. The width of the bed inside the culvert shall be 1.2 times the bankfull width plus 2 feet or greater. The width shall be 12 feet for the Willows Creek culvert (based on a measured bankfull width of 8 feet).

35. Footings of the bottomless culvert shall be buried sufficiently deep so they will not become exposed by scour within the culvert. Pin pile foundations will support the culvert.

36. The culvert shall be installed to maintain structural integrity to the 100-year peak flow with consideration of the debris likely to be encountered.

37. Fill associated with the culvert installation shall be protected from erosion to the 100-year peak flow.

38. The culvert shall be installed and maintained to avoid inlet scouring and to prevent erosion of stream banks downstream of the project.

39. The culvert facility shall be maintained by the owner(s) per RCW 77.57.030 to ensure continued, unimpeded fish passage. If the structure becomes a hindrance to fish passage, the owner(s) shall be responsible for obtaining an Hydraulic Project Approval and providing prompt repair. Financial responsibility for maintenance and repairs shall be that of the owner(s).

40. The culvert shall be installed in the dry or in isolation from the stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area.

41. The slope of the culvert bed shall not exceed 1.25 times the upstream channel slope. The approved culvert slope for Willows Creek is 3.2 percent based on measured stream bed slope of 3.2 percent.

42. The culvert shall not exceed 25 feet in total length.

43. The culvert shall be countersunk with streambed material by at least 25 percent for a bottomless culvert, or a minimum of 30 percent for a round culvert.

44. Streambed gravel shall be rounded; including 65 percent streambed sediment (2.5-inch minus), 20 percent 6-inch streambed cobbles, and 15 percent 10-inch streambed cobbles to simulate naturally occurring stream substrate. Streambed gravel shall be well-graded, non-porous, and include 5 to 10 percent fines to prevent flow from going subsurface.

45. Bed control rocks shall be rounded one- and two-man rock (50 percent one-man rock and 50 percent two-man rock) and placed to establish low flow channel geometry on either end of the culvert and limit stream bank transitions directly upstream and downstream of the culvert. Bed control rocks shall be placed to initiate stream bed structure and prevent flow from running along the sides of the culvert.

46. Disturbance of the streambed and banks shall be limited to that necessary to place the culvert and any required channel modification associated with it. Affected streambed and bank areas outside the culvert and associated fill shall be restored to preproject or improved habitat configuration following installation of the culvert.

47. Approach material shall be structurally stable and be composed of material that, if eroded into the stream, shall not be detrimental to fish life.

SITE RESTORATION AND MITIGATION

48. Rip rap associated with the railroad fill and existing deposited sediment between the culvert to be replaced and the upstream culvert will be removed as part of the project. Banks will be restored to 3:1 slopes and planted with riparian woody vegetation.

49. Within seven calendar days of project completion, all disturbed areas shall be protected from erosion using vegetation or other means. Within one year of project completion, temporarily disturbed areas shall be revegetated with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center) and maintained as necessary for three years to ensure 80 percent survival.

50. The submitted planting plan shall be implemented to mitigate for impacts to wetlands, wetland buffers, and stream buffers. Monitoring and site management shall be conducted for at least five years as indicated in the Wetland and Buffer Mitigation Report to achieve the identified performance criteria.

51. All trash and unauthorized fill, including concrete blocks or pieces, bricks, asphalt, metal, treated wood, glass, plastic, etc., below the OHWL in and around the project area shall be removed and deposited above the limit of flood water in an approved upland disposal site.

52. All erosion control materials that will remain onsite shall be composed of 100% biodegradable materials.

LOCATION #1:	Site Name: Redmond Central Connector Phase II BNSF corridor, east of Sammamish River, Redmond, WA

HYDRAULIC PROJECT APPROVAL

Washington Department of
Fish & Wildlife
PO Box 43234
Olympia, WA 98504-3234
(360) 902-2200

Issued Date: June 12, 2015
Project End Date: December 31, 2016

Permit Number: 2015-4-399+01
FPA/Public Notice Number: N/A
Application ID: 1760

WORK START:	June 12, 2015			WORK END:	December 31, 2016	
WRIA		Waterbody:			Tributary to:	
08 - Cedar - Sammamish		Sammamish River			Lake Washington	
1/4 SEC:	Section:	Township:	Range:	Latitude:	Longitude:	County:
S 1/2	11	25 N	05 E	47.674766	-122.133123	King
Location #1 Driving Directions						

From the north:
• Take I-405 south
• Take exit 20 for NE 124th Street
• Turn left onto NE 124thStreet
• Turn right onto Willows Road
• Site is on the left (east)

From the south:
• Take WA-520 east towards Bellevue/Kirkland
• Take the West Lake Sammamish Parkway Northeast exit
• Turn left onto West Lake Sammamish Parkway NE
• Continue onto 154th Avenue NE
• Cross under Redmond Way, and then the railroad (trail) overpass will be a bit farther to the north.

LOCATION #2:	Site Name: Redmond Central Connector Phase II BNSF corridor, Willows Creek, Redmond, WA 98052					
WORK START:	June 12, 2015			WORK END:	December 31, 2016	
WRIA		Waterbody:			Tributary to:	
08 - Cedar - Sammamish		Unknown Stream Number			Unknown	
1/4 SEC:	Section:	Township:	Range:	Latitude:	Longitude:	County:
NE 1/4	03	25 N	05 E	47.68545	-122.145824	King
Location #2 Driving Directions						

From the north:
- Take I-405 south
- Take exit 20 for NE 124th Street
- Turn left onto NE 124thStreet
- Turn right onto Willows Road
- Site is on the left (east)

From the south:
- Take WA-520 east towards Bellevue/Kirkland
- Take the West Lake Sammamish Parkway Northeast exit
- Turn left onto West Lake Sammamish Parkway NE
- Continue onto 154th Avenue NE
- Cross under Redmond Way, and then the railroad (trail) overpass will be a bit farther to the north.

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW. Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person (s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued under RCW 77.55.021 are subject to additional restrictions, conditions, or revocation if the Department of Fish and Wildlife determines that changed conditions require such action. The person(s) to whom this Hydraulic Project Approval is issued has the right to appeal those decisions. Procedures for filing appeals are listed below.

HYDRAULIC PROJECT APPROVAL

Issued Date: June 12, 2015
Project End Date: December 31, 2016

Permit Number: 2015-4-399+01
FPA/Public Notice Number: N/A
Application ID: 1760

MINOR MODIFICATIONS TO THIS HPA: You may request approval of minor modifications to the required work timing or to the plans and specifications approved in this HPA. Any approved minor modification will require issuance of a letter documenting the approval. A minor modification to the required work timing means any change to the work start or end dates of the current work season to enable project or work phase completion. Minor modifications will be approved only if spawning or incubating fish are not present within the vicinity of the project. You may request subsequent minor modifications to the required work timing. A minor modification of the plans and specifications means any changes in the materials, characteristics or construction of your project that does not alter the project's impact to fish life or habitat and does not require a change in the provisions of the HPA to mitigate the impacts of the modification. Minor modifications do not require you to pay additional application fees or be issued a new HPA. If you originally applied for your HPA through the online Aquatic Protection Permitting System (APPS), you may request a minor modification through APPS. A link to APPS is at http://wdfw.wa.gov/licensing/hpa/. If you do not use APPS you must submit a written request that clearly indicates you are seeking a minor modification to an existing HPA. Written requests must include the name of the applicant, the name of the authorized agent if one is acting for the applicant, the control number of the HPA, the date issued, the permitting biologist, the requested changes to the HPA, the reason for the requested change, the date of the request, and the requestor's signature. Send by mail to: Washington Department of Fish and Wildlife, PO Box 43234, Olympia, Washington 98504-3234, or by email to HPAapplications@dfw.wa.gov. Do not include payment with your request. You should allow up to 45 days for the department to process your request.

MAJOR MODIFICATIONS TO THIS HPA: You may request approval of major modifications to any aspect of your HPA. Any approved change other than a minor modification to your HPA will require issuance of a new HPA. If you paid an application fee for your original HPA you must pay an additional $150 for the major modification. If you did not pay an application fee for the original HPA, no fee is required for a change to it. If you originally applied for your HPA through the online Aquatic Protection Permitting System (APPS), you may request a major modification through APPS. A link to APPS is at http://wdfw.wa.gov/licensing/hpa/. If you do not use APPS you must submit a written request that clearly indicates you are requesting a major modification to an existing HPA. Written requests must include the name of the applicant, the name of the authorized agent if one is acting for the applicant, the control number of the HPA, the date issued, the permitting biologist, the requested changes to the HPA, the reason for the requested change, the date of the request, payment of the application the original application was subject to an application fee, and the requestor's signature. Send your written request and payment, if applicable, by mail to: Washington Department of Fish and Wildlife, PO Box 43234, Olympia, Washington 98504-3234. You should allow up to 45 days for the department to process your request.

APPEALS INFORMATION

If you wish to appeal the issuance, denial, conditioning, or modification of a Hydraulic Project Approval (HPA), Washington Department of Fish and Wildlife (WDFW) recommends that you first contact the department employee who issued or denied the HPA to discuss your concerns. Such a discussion may resolve your concerns without the need for further appeal action. If you proceed with an appeal, you may request an informal or formal appeal. WDFW encourages you to take advantage of the informal appeal process before initiating a formal appeal. The informal appeal process includes a review by department management of the HPA or denial and often resolves issues faster and with less legal complexity than the formal appeal process. If the informal appeal process does not resolve your concerns, you may advance your appeal to the formal process. You may contact the HPA Appeals Coordinator at (360) 902-2534 for more information.

Washington Department of
Fish & Wildlife
PO Box 43234
Olympia, WA 98504-3234
(360) 902-2200

HYDRAULIC PROJECT APPROVAL

Issued Date: June 12, 2015
Project End Date: December 31, 2016

Permit Number: 2015-4-399+01
FPA/Public Notice Number: N/A
Application ID: 1760

A. INFORMAL APPEALS: WAC 220-110-340 is the rule describing how to request an informal appeal of WDFW actions taken under Chapter 77.55 RCW. Please refer to that rule for complete informal appeal procedures. The following information summarizes that rule.

A person who is aggrieved by the issuance, denial, conditioning, or modification of an HPA may request an informal appeal of that action. You must send your request to WDFW by mail to the Washington Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091; e-mail to HPAapplications@dfw.wa.gov; fax to (360) 902-2946; or hand-delivery to the Natural Resources Building, 1111 Washington St SE, Habitat Program, Fifth floor. WDFW must receive your request within 30 days from the date you receive notice of the decision. If you agree, and you applied for the HPA, resolution of the appeal may be facilitated through an informal conference with the WDFW employee responsible for the decision and a supervisor. If a resolution is not reached through the informal conference, or you are not the person who applied for the HPA, the HPA Appeals Coordinator or designee will conduct an informal hearing and recommend a decision to the Director or designee. If you are not satisfied with the results of the informal appeal, you may file a request for a formal appeal.

B. FORMAL APPEALS: WAC 220-110-350 is the rule describing how to request a formal appeal of WDFW actions taken under Chapter 77.55 RCW. Please refer to that rule for complete formal appeal procedures. The following information summarizes that rule.

A person who is aggrieved by the issuance, denial, conditioning, or modification of an HPA may request a formal appeal of that action. You must send your request for a formal appeal to the clerk of the Pollution Control Hearings Boards and serve a copy on WDFW within 30 days from the date you receive notice of the decision. You may serve WDFW by mail to the Washington Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091; e-mail to HPAapplications@dfw.wa.gov; fax to (360) 902-2946; or hand-delivery to the Natural Resources Building, 1111 Washington St SE, Habitat Program, Fifth floor. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, you may request a formal appeal within 30 days from the date you receive the Director's or designee's written decision in response to the informal appeal.

C. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS: If there is no timely request for an appeal, the WDFW action shall be final and unappealable.

Habitat Biologist	Angie.Peace@dfw.wa.gov		for Director
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Appendix F — Geotechnical Report

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Geotechnical Engineering Services

Redmond Central Connector, Phase II
Redmond, Washington

for
City of Redmond and
Otak

May 15, 2015

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Redmond Central Connector, Phase II
Redmond, Washington

for
City of Redmond and
Otak

May 15, 2015

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Geotechnical Engineering Services

Redmond Central Connector, Phase II
Redmond, Washington

File No. 0500-172-02

May 15, 2015

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GEOENGINEERS

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INTRODUCTION

This report presents the results of our geotechnical engineering services for the Redmond Central Connector (RCC) Phase II project in Redmond, Washington. The site is shown relative to surrounding physical features on the Vicinity Map, Figure 1, and the Site Plans, Figures 2A through 2H.

The recommendations within this report build upon the preliminary geotechnical design recommendations we submitted in our memorandum dated September 25, 2013 and our 60 percent design report dated November 4, 2014. This report incorporates project team comments provided on the memorandum and draft report and provides additional recommendations based on project modifications.

Our geotechnical engineering services were completed in general accordance with the Subconsultant Agreement between GeoEngineers, Inc. (GeoEngineers) and Otak dated May 16, 2013 and Amendment No. 1 dated September 17, 2014.

PROJECT DESCRIPTION

Our understanding of the project is based on discussions with and information provided by the Otak project team, the City of Redmond, 95 percent design plans dated April 2014, and our experience with similar projects. We understand that the project will complete Phase II of a regional trail that extends from the existing RCC along the existing Burlington Northern Santa Fe (BNSF) rail corridor. Phase II will extend from just east of the Sammamish River (Station 6+50) to about NE 100th Court (Station 74+50), and parallels Willows Road NE for much of the alignment.

For the purposes of discussion, the alignment has been divided into three sections based on topography, soil conditions and design/construction issues. Section A extends from just east of the Sammamish River to 154th Avenue NE (Station 6+50 to 15+00). Section B extends from just west of 154th Avenue NE to the valley floor (Station 15+00 to 35+00). Section C continues within the flat portion of the valley floor to the end of the project alignment (Station 35+00 to 74+50).

FIELD EXPLORATIONS AND LABORATORY TESTING

Field Explorations

The subsurface soil and groundwater conditions at the site were evaluated by reviewing existing geotechnical information and completing six borings (B-1-14 through B-6-14) and 15 hand auger explorations (HA-1-13 through HA-10-13 and HA-11-14 through HA-15-14). The borings were completed to depths ranging from 16½ to 41½ feet below the ground surface. The hand explorations were completed to depths ranging from 1 to 5 feet below the ground surface. The approximate locations of the borings and hand explorations are shown on the Site Plans, Figures 2A through 2H. Details of the field exploration program, logs of the borings and hand explorations, and a key to the exploration logs are presented in Appendix A.

Laboratory Testing

Selected soil samples obtained during the exploration program were submitted to our laboratory to be tested for the determination of moisture content, grain size distribution (sieve analyses), and plasticity characteristics (Atterberg limits). A description of the laboratory testing and the test results are presented in Appendix B.

PREVIOUS EXPLORATIONS

Subsurface soil and groundwater information from previous projects in the project vicinity completed by GeoEngineers and others is included in Appendix C. The approximate locations of the previous explorations are shown on the Site Plans, Figures 2A through 2H.

SITE CONDITIONS

Site Geology

The majority of the project corridor lies within the floor of the Sammamish River Valley, a broad, north-south trending valley resulting from several glacial episodes of glacial scouring in the Puget Sound region. The valley was subsequently filled with recessional glacial outwash deposits, post glacial deposits, older alluvial deposits, and younger alluvial deposits. Younger alluvial deposits are mapped along the majority of the project corridor and primarily include peat, silt, sand and gravel. A small portion of the corridor lies along the toe of the valley and is mapped as older alluvial deposits that also include peat, silt, sand and gravel. Another small portion of the corridor lies along the terrace at the edge of the valley and is mapped as transitional beds. Transitional beds typically consist of clay, silt and fine sand with gravel in the lower portion of the formation. The ground is disturbed and/or fill has been placed in portions of the valley as a result of past agricultural and construction activities. Fill is present along the project corridor from the previous railroad construction.

Sensitive Area Designations

Sensitive areas maps produced by the City of Redmond indicate that the project area is within a Seismic Hazard Area and Critical Aquifer Recharge Area (Wellhead Protection Zones 3 and 4). The seismic hazard is due to the presence of moderately dense sandy alluvium below groundwater that could liquefy if these soils were subjected to strong, earthquake-induced ground shaking. The aquifer recharge sensitive classification is the result of the upper sand and gravel formation (aquifer) being in direct continuity with the ground surface and is therefore at risk of degradation of water quality from surface spills of contaminants. The City of Redmond water wells are established in this upper sand and gravel aquifer.

No mapped landslide or erosion hazards are located along the proposed trail corridor (City of Redmond Map 64.7, Landslide Hazard Areas and City of Redmond Map 64.8, Erosion Hazard Areas). However, based on the City of Redmond Code, slopes greater than 30 percent are classified as a landslide hazard and slopes of 40 percent or greater are classified as steep slopes and require an on-site evaluation. As described in the “Surface Conditions” section below, slopes greater than 40 percent were observed along the RCC Phase II corridor. The reconnaissance completed for this study satisfies the requirement for an on-site evaluation per the City of Redmond Code.

Surface Conditions

The RCC Phase II corridor runs along the former BNSF Rail Corridor. The corridor is generally ballast covered (railroad tracks were removed previously). For the purposes of this evaluation, we are subdividing the corridor into three subsections based on topography and subsurface conditions.

- **Section A** (Station 6+50 to 15+00) includes the Sammamish River Trail, Sammamish River, and 154th Avenue NE crossings. A single bridge trestle spans the Sammamish River Trail and the Sammamish River, and is abutted on either side by embankments reaching heights of up to 20 feet in relation to the surrounding grade. A second bridge trestle spans 154th Avenue NE and is abutted by the embankment to the east and an embankment grading in to the terrace to the west. Embankment grades range between 1.3H:1V (horizontal to vertical) and 3H:1V. The embankment slopes are generally covered with railroad ballast and locally covered with quarry spalls.
- **Section B** (Station 15+00 to 35+00) begins after the west abutment of the 154th Avenue NE Bridge and extends along the edge of the terrace on the southwest side of the corridor. The southwest slope of the embankment is largely in cut with slopes on either side of the embankment reaching grades of up to 1.4H:1V (70 percent slope). An 8-foot high cantilever soldier pile wall to the northeast of the trail supports a cut for the parking lot of a business in the vicinity of Station 19+50. The soldier pile wall transitions to a 3-foot rockery at about Station 24+10. Exposed slopes are generally covered with railroad ballast, locally with quarry spalls or are generally vegetated with deciduous trees and brush. Groundwater seepage is collected into a ditch immediately west of the railroad prism from the southwest slope in the vicinity of Station 20+00 to 30+00 and is locally observed draining onto the parking lot to the northeast in the vicinity of Station 25+60.
- **Section C** (Station 35+00 to 74+50) begins as the RCC corridor transitions from a cut condition along the edge of the terrace to a fill embankment or relatively level grade through the Sammamish River valley. The RCC corridor is situated adjacent to Willows Road to the southwest and business parks and parking lots to the northeast. Between about Stations 35+00 and 37+00, the fill embankment slopes are typically inclined between 3H:1V and 1.4H:1V. Flatter slopes are present near the parking lots to the northeast. North of Station 37+00, the slopes gradually flatten and the RCC corridor is generally level with the adjacent grade. Slopes are generally covered with quarry spalls or river rock. A small concrete bridge accommodates the crossing over Peters Creek at about Station 49+05, and two culverts cross below the RCC corridor within Section C (at about Stations 34+30 and 65+00). A new open bottom arch culvert at Station 65+00 (Willows Creek) is proposed to replace the existing pipe culvert. Through this section of the corridor, ground cover adjacent to the trail generally consists of grass and shrubs.

Subsurface Conditions

Soil Conditions

Based on subsurface data from the borings and hand augers and on review of existing geotechnical information, the corridor is generally underlain by the following soil units:

- **Fill** consisting predominately of loose to medium dense silty sand with gravel and gravel with silt was encountered in the BNSF embankments. Isolated zones of very dense gravel with silt and medium stiff to stiff silt were also encountered. The fill varies in thickness along the alignment. The largest thickness of fill encountered was approximately 24 feet at boring B-2-14.

- **Fine Grained Alluvial Deposits** are present below the fill in Sections A and C of the RCC Phase II corridor. The alluvial deposits consist of layers of loose to medium dense sand to silty sand and very soft to medium stiff silt, clay and peat. Based on the explorations, the alluvium extends to depths ranging between about 10 and 20 feet below existing grades through the river valley.
- **Coarse-Grained Alluvial Deposits and Recessional Outwash** underlie the fill and fine-grained alluvium in the Sammamish River valley. The coarse-grained alluvial deposits generally consist of medium dense to very dense sand and gravel with varying amounts of silt. Previous experience in the area suggests that there may be abundant oversized material in the coarse-grained alluvium and outwash. Excavations in the area have encountered abundant cobbles and occasional boulders.
- **Transitional Beds** consisting of very stiff to hard/dense to very dense silt, clay and sand were observed in explorations completed along the terrace to the southwest of the Sammamish River valley, in Section B of the project corridor.

Groundwater Conditions

Groundwater is relatively shallow and fluctuates seasonally and also in response to flood events with both direct infiltration, as well as in response to the water level in the Sammamish River. As part of the City's wellhead protection program, a numerous array of wells distributed throughout the city have been read regularly over the past several years affording a database of groundwater levels throughout the city and subsequently around the project area. Groundwater data and observations during drilling indicate that the seasonal low and high levels near the Sammamish River crossing range between approximately Elevation 23 and 28 feet. In addition, perched groundwater seepage was observed at a depth of about 5 feet in hand exploration HA-2 and at the toe of slopes along Section B of the corridor.

A monitoring well was installed in boring B-6-14 completed near the Willows Creek crossing. Table 1 summarizes the data from monitoring well B-6-14. The location of the monitoring well is presented in Figure 2G.

TABLE 1. SUMMARY OF GROUNDWATER DATA

Well ID	Ground Surface Elevation[1] (feet)	Groundwater Elevation[1] (feet) and date of reading
B-6-14	44.3	26.7 (October 16, 2014)

Notes:
[1] Datum = NAVD88

Groundwater conditions encountered in excavations during construction will depend on the time of year, amount of recent and previous rainfall, stage of the Sammamish River and other indeterminate factors.

CONCLUSIONS AND RECOMMENDATIONS

Summary of Geotechnical Considerations

We conclude that the planned improvements can be successfully completed from a geotechnical perspective, provided the considerations presented in this report are incorporated into the project planning and design. A summary of the primary geotechnical considerations is provided below. The summary is

presented for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The fill soils within the railroad embankment are suitable for reuse as structural fill; albeit only during dry weather grading. Because the embankment fill soils generally contain a significant amount of silt, we recommend that they not be used for structural fill during the wet season.
- The soils in Section C (the valley floor) are suitable for low to moderate stormwater infiltration for shallow facilities. Low infiltration rate soils are present along the remainder of the alignment.
- In Section A, the groundwater level encountered in previous borings varied from about 13 to 15 feet below the ground surface on the east side of the Sammamish River (from top of railroad embankment). On the western side of the Sammamish River, groundwater was observed at a depth of 11 feet in a previous boring and at 17 feet in the boring completed for this study. Groundwater observations were typically observed during late fall and are expected to fluctuate with changes in season, precipitation, and the stage of the Sammamish River. In Section B, the borings completed for this study did not encounter groundwater within the top 15 feet. In Section C, the depth to groundwater was measured at a depth of about 17½ feet in a monitoring well (B-6-14) installed for this study.
- Appropriate retaining wall systems for use on the project include modular block gravity walls, concrete cantilever walls, and/or mechanically stabilized earth (MSE) walls.
- Based on observations during drilling, a layer of peat is present near the foundation subgrade elevation for the proposed culvert at Willows Creek. The peat deposits will settle over time and are not suitable for direct foundation support. We recommend that the culvert be supported on driven steel pipe piles that extend through the peat and are embedded in the underlying denser coarse-grained alluvial and recessional outwash deposits.
- The proposed culvert at Willows Creek will require temporary dewatering in order to construct the culvert. We anticipate that dewatering can be completed using open pumping, provided the work is done during the dry season.

These and other geotechnical considerations are discussed further, and recommendations pertaining to the geotechnical aspects of the project are presented in the following sections of this report.

Earthquake Engineering

AASHTO Seismic Design Information

For this alignment, we recommend the following American Association of State Highway and Transportation Officials (AASHTO) parameters for Site Class, peak ground acceleration (PGA), short period spectral response acceleration (Ss), 1-second period spectral response acceleration (S1), and Seismic Coefficients FPGA, FA and FV. The values presented below are based on the 2002 United States Geologic Survey (USGS) National Seismic Hazards Mapping project for determining a peak ground (bedrock) acceleration coefficient for design for an earthquake that has a 7 percent probability of exceedance in a 75-year period (approximate 1,000-year return period).

TABLE 2. AASHTO SEISMIC DESIGN PARAMETERS

2012 AASHTO Parameter	Sections A and C	Section B
Site Class	E	C
Peak Ground Acceleration	40	40
Short Period Spectral Response Acceleration, S_S (percent g)	89	89
1-Second Period Spectral Response Acceleration, S_1 (percent g)	30	30
Seismic Coefficient, F_{PGA}	0.91	1.00
Seismic Coefficient, F_A	1.04	1.05
Seismic Coefficient, F_V	2.82	1.50

Seismic Hazards

We evaluated the site conditions for seismic hazards including liquefaction, lateral spreading, and seismically induced landsliding. Our evaluation indicates that Sections A and C of the project corridor have moderate risk of liquefaction because of the presence of loose to medium dense relatively clean sands (alluvium deposits) below the groundwater level. Because there is a moderate risk of liquefaction, the site has a moderate risk of liquefaction-induced ground disturbance. There is also a low potential for seismically induced landsliding and/or lateral spreading resulting from liquefaction.

Our evaluation indicates that Section B of the project corridor has a low risk of liquefaction.

Surface Fault Rupture

Based on USGS maps of active faults in the Puget Sound region, the site is located approximately 6½ miles north of the Seattle Fault Zone. Because the thickness of Quaternary sediments below the site, which are commonly more than 1,000 feet thick, and lack of fault displacement evidence in the area, the potential for surface fault rupture is considered low.

Infiltration Evaluation

General

We understand the City of Redmond is adopting the 2012 Department of Ecology (DOE) Stormwater Management Manual for Western Washington (SMMWW). However, some regulations may still be governed by the 2005 SMMWW. As such, we have determined design infiltration rates using methodologies in both the 2005 SMMWW and the 2012 SMMWW.

2005 Methodology

In the 2005 SMMWW Manual, the design infiltration rates can be determined using one of the three methodologies outlined in Volume III, Chapter 3 and Appendix C. These methods include United States Department of Agriculture (USDA) Textural Classification, American Society for Testing and Materials (ASTM) Gradation, or In-Situ Infiltration Measurements.

The USDA and ASTM methods were used to evaluate design infiltration rates for the fill, transitional beds and alluvial deposits encountered at the site. The methods consist of correlations based on sieve analysis and textural classification, as discussed in Section 3.3.6 of the SMMWW.

The table below presents a summary of the estimated long-term (design) infiltration rates for the fill/transitional/alluvium deposits in the upper ½ to 5 feet, based on USDA and ASTM correlations for infiltration.

TABLE 3. INFILTRATION RECOMMENDATIONS BASED ON 2005 SMMWW MANUAL

Exploration	Section	Depth (feet)	USCS Classification	USDA Textural Class	USDA Long-term Infiltration Rate (in/hr)	Estimate of Short-Term Infiltration Rate Based on USDA Method (in/hr)	ASTM Long-term Infiltration Rate (in/hr)
HA-1-13	C	1	GP-GM	Sand	2	8	3.5
HA-2-13	C	4.5	SM	Loamy Sand	0.5	2	0.3
HA-4-13	C	5	SM	Sand	2	8	1.4
HA-7-13	B	0.5	SM	Sandy Loam	0.25	1	0.15
HA-8-13	B	2	CL	Clay Loam	n/a[1]	n/a[1]	n/a[1]
HA-9-13	B	2.5	SM	Loam	0.13	0.5	n/a
HA-10-13	B	2	CL	Clay Loam	n/a[1]	n/a[1]	n/a[1]
HA-11-14	C	1.5	SP-SM	Fine Sand	2	8	3.5
HA-12-14	C	0.5	SM	Silt Loam	n/a[1]	n/a[1]	0.1
HA-13-14	C	1.5	SM	Sandy Loam	0.25	1	0.1
HA-14-14	C	1.5	SM	Sandy Loam	0.25	1	0.8
HA-15-14	C	1.5	SM	Silt Loam	n/a[1]	n/a[1]	0.15
B-3-14	B	5	SM	Sandy Loam	0.25	1	0.1
B-4-14	B	2.5	CL	Silt	n/a[1]	n/a[1]	n/a[1]
B-5-14	B	2.5	SM	Sandy Loam	0.25	1	0.2

Notes:

[1]SMMWW does not provide guidance for these fine-grained soils.

2012 Methodology

In the 2012 Manual, the design infiltration rates (saturated hydraulic conductivity) can be determined using one of the three methodologies outlined in Volume III, Chapter 3.3. These methods include Large Scale Pilot Infiltration Test (PIT), Small Scale PIT, or Soil Grain Size Analysis Method.

The soil grain size analysis method was used to evaluate design infiltration rates for the fill, transitional beds and alluvium encountered along the corridor. The methods consist of correlations based on more detailed sieve analysis results (compared to the 2005 SMMWW), as discussed in Section 3.3.6.

The table below presents a summary of the estimated design saturated hydraulic conductivity for the fill/transitional/alluvium deposits in the upper ½ to 5 feet.

TABLE 4. INFILTRATION RECOMMENDATIONS BASED ON 2012 SMMWW MANUAL

Exploration	Section	Depth (feet)	K_{sat} (in/hr) initial	Total Correction Factor	K_{sat} (in/hr) design
HA-1-13	C	1	50	0.1188	5.9
HA-2-13	C	4.5	17	0.1188	2.0
HA-4-13	C	5	29	0.1188	3.5
HA-7-13	B	0.5	3.3	0.1188	0.4
HA-8-13	B	2	1.4	0.1188	0.2
HA-9-13	B	2.5	3.2	0.1188	0.4
HA-10-13	B	2	1.1	0.1188	0.1
HA-11-14	C	1.5	51	0.1188	6.0
HA-12-14	C	0.5	6.7	0.1188	0.8
HA-13-14	C	1.5	10.4	0.1188	1.2
HA-14-14	C	1.5	16.7	0.1188	2.0
HA-15-14	C	1.5	5.8	0.1188	0.7
B-3-14	B	5	8.8	0.1188	1.0
B-4-14	B	2	0.6	0.1188	<<0.1
B-5-14	B	2.5	11.1	0.1188	1.3

Notes:

[1]Total Correction Factor based on CF_v = 0.33, Cf_t = 0.40 and CF_m = 0.9.

Design Infiltration Rates

Based on the hand auger samples and lab testing data, we recommend long term design infiltration rates of 0.5 to 2.0 inches per hour in Section C and 0.1 inches per hour in Section B. The infiltration rate will vary depending on the gradation and density of the near surface fill or native soils. Design of individual facilities also require additional site analysis in accordance with the 2012 SMMWW such as flood hazards adjacent to the site, geologic hazard buffer areas, wellhead protection areas, and topographic features that may act as storage or conveyance. We understand that infiltration facilities are not currently planned for Section A.

As discussed in Section 3.3.4 of the 2012 SMMWW, the grain size analysis method is typically not appropriate for glacially consolidated soils such as the transitional beds in Section B. Further, it should be noted that the infiltration rates presented herein are based on design guidelines that are generally conservative. We recommend completing on-site PIT testing to establish more site-specific infiltration performance values, if feasible. We also recommend that site soils be evaluated by the Geotechnical Engineer during construction to confirm that the recommended infiltration rate is appropriate.

Porous Pavement Design

General

The design of porous pavements for stormwater management should consider storage capacity of the pervious pavement system and infiltration rate of the subgrade soils, as well as water quality treatment.

Porous pavement may consist of porous concrete, porous hot mix asphalt (HMA), porous pavers or some type of stabilized gravel surface. Porous pavements should be designed in accordance with Volume V Runoff Treatment Best Management Practices (BMP) T5.15 of the 2012 SMMWW. Our recommendations for design are presented in the following subsections.

Infiltration

The long-term infiltration rate is dependent on several factors, including site variability, degree of long-term maintenance, pretreatment for total suspended solids and depth to groundwater. For design of porous pavements, it is typically assumed that there will be low to moderate long-term maintenance and pretreatment. Refer to our "Infiltration Evaluation" section of this report for recommended infiltration rate values.

Storage Capacity

The total stormwater storage capacity of the porous pavement system includes the capacity of the porous pavement and the capacity of the crushed rock subbase and underlying on-site soils in the planned improvement areas. The storage capacity is directly dependent on the effective porosity (or percent voids) of the pavement, subbase, and on-site materials that can be filled with stormwater. The porosity of pervious pavement depends on the mix design. The effective porosity used for design should be adjusted to account for naturally occurring moisture.

We recommend that shoulder ballast be used for the crushed rock subbase below the porous surface. The shoulder ballast should meet the criteria described in Section 9-03.9(2) of the Washington State Department of Transportation (WSDOT) Standard Specifications. Based on previous laboratory testing of crushed rock samples (1¼-inch and ⅝-inch clean crushed rock), we anticipate a total porosity of approximately 40 to 45 percent. For design, we recommend an effective porosity of 35 percent to account for natural moisture and the ingress of fines. The storage capacity for the crushed rock subbase should be calculated by multiplying the volume of subbase by the effective porosity. Typical subbase thicknesses range from 12 to 36 inches, depending on storage needs. A minimum of 6 inches of subbase should be used at this site to help "bridge" over the amended subgrade soils, if used.

Additionally, landscaping areas adjacent to the porous sidewalks and pavement should be sloped to drain away from the sidewalk so that fines in runoff from the landscaping areas can be prevented from contaminating and reducing the storage capacity of the porous surface and crushed rock subbase.

Low Impact Development Facility

We understand that the project will include Low Impact Development (LID) components, such as infiltration trenches and vegetated dispersion strips, for stormwater management along the alignment. In addition to the recommendations presented in the "Earthwork Considerations" section of this report, we recommend the following site preparation recommendations for LID facilities. Refer to our "Infiltration Evaluation" section of this report for recommended infiltration rate values.

Facilities should be excavated to final depth and configuration using equipment that operates outside the footprint of the LID component. Under no circumstances should equipment be allowed with the footprint of the LID component; otherwise the native soil subgrade could be compacted by the weight of the equipment

and possibly reduce the infiltration performance of the soil. Consideration should be given to hand raking the final subgrade to help scarify the subgrade.

Infiltration trenches should be encapsulated with a non-woven geotextile (Mirafi 140N, or similar).

Stormwater runoff should not be allowed to enter the vegetated dispersion strips until vegetation is established. This is particularly critical during the construction phase when stormwater runoff can be very silty, which would result in a decreased infiltration capacity.

Slope Stability

As described in the "Site Conditions" section, slopes greater than 40 percent were observed along the RCC Phase II corridor, requiring an on-site evaluation per the City of Redmond Code. The geologic reconnaissance completed for this study satisfies the on-site evaluation. We did not observe indications of slope instability during the geologic reconnaissance.

To further explore the global static and seismic (pseudo-static) stability of steep slope areas, we performed slope stability analysis at approximate Stations 12+80 and 18+00. Station 12+80 is located at the embankment between the Sammamish River bridge crossing and 154th Avenue NE bridge crossing. The Station 18+00 location was selected as indicative of a typical slope along the RCC Phase II corridor, where the fill railroad embankment is situated near the base of a steep slope. The Station 18+00 analysis section extended laterally up slope about 120 feet and down slope about 60 feet. While this distance is beyond the extent of the project survey, topography estimated in the field and from available aerial imagery was used to extend the profile.

For our analyses, we used the slope stability program Slope/W. This program has the capability of analyzing slope stability for a wide range of slope and failure surface geometries along with multiple subsurface soil layers. Various groundwater conditions can also be modeled.

Stability analyses were performed for both static and under pseudo-static seismic loading. A pseudo-static horizontal acceleration coefficient of 0.20g was used in the analysis and was calculated following AASHTO methodology. The pseudo-static coefficient represents a fraction (in this case approximately one-half) of the PGA for an earthquake with a return interval of 1,000 years based on USGS probabilistic seismic hazard maps.

The results for the static and seismic cases are presented in Table 5. As indicated in the table, the static factor of safety (FOS) for both conditions is greater than the minimum FOS of 1.25 outlined in the WSDOT Geotechnical Design Manual (GDM) for general slope stability analysis of permanent cuts and fills. For seismic analysis of cuts and fills, the GDM recommends a minimum FOS of 1.05. The seismic FOS of the trail embankment at Station 12+80 is less than this minimum factor of safety. We understand that the trail is not being designed to resist seismic loading. Maintenance and repair of the trail may be needed following a seismic event with shaking near or above the design-level PGA.

TABLE 5. STABILITY ANALYSIS RESULTS (EXISTING CONDITION)

Analysis Section Stationing	Factor of Safety for Static Loading Condition	Factor of Safety for Seismic Loading Condition[1]
12+80	1.4	0.9
18+00	1.8	1.1

Notes:

[1] Seismic event with a 1,000-year recurrence interval.

Pavement Design

General

Aside from shorter sections of concrete or unit pavers at bridge approaches or roadway crossings, pavement for RCC Phase II will consist of porous pavement or HMA. Specific porous pavement design considerations are discussed in the "Porous Pavement Design" section. The sections below present recommendations for subgrade preparation for all paved/hardscape surfaces and specific recommendations for HMA pavement sections.

Subgrade Preparation

We recommend that the subgrade soils in all new pavement areas be prepared and evaluated as described in the "Earthwork" section of this report. We recommend that the subgrade be compacted to at least 95 percent of the MDD prior to placing HMA pavement section materials. If the subgrade soils are loose or soft, it may be necessary to excavate the soils and replace them with structural fill. A layer of suitable woven geotextile fabric may be placed over soft subgrade areas to limit the thickness of structural fill required to bridge soft, yielding areas. Subgrade preparation for porous pavement areas may include removal of the topsoil and vegetation and little to no compaction depending on the design infiltration rate, exposed soil conditions, and pavement use.

New Hot Mix Asphalt Pavements

At a minimum, we recommend that new HMA pavement sections for the trail be designed in accordance with City of Redmond minimum surfacing requirements for private streets and parking lots, as presented in the City of Redmond Standard Specifications and Details, 2014. The minimum recommendations for private streets and parking lots consist of 3 inches of HMA Class ½ inch, PG 64-22, overlying 4 inches of 1¼ inch crushed surfacing base course meeting the requirements of WSDOT Standard Specification 9-03.9(3). We recommend that these values be checked against calculated sections based upon an appropriate pavement design procedure using actual traffic data such as the AASHTO Guide for Design of Pavement Structures.

Pavement Transitions

HMA pavement or porous pavement are planned along the majority of the alignment, but hardscape consisting of concrete or unit pavers are planned at trail transitions, such as bridge approaches and driveway and roadway crossings. To mitigate the potential for differential settlement at these pavement transitions, we recommend that a biaxial geogrid be installed below the pavement section, extending 15 feet on either side of the pavement transition zone. The biaxial geogrid can be installed directly over the subgrade below HMA and concrete/paver sections and over the permeable ballast layer below porous pavement sections.

Earthwork

General

Fill (primarily associated with the railroad grade) overlying alluvium in the valley and transitional beds in the uplands were observed in the previous explorations. We anticipate that these soils can be excavated with conventional grading equipment, such as track excavators or dozers.

The contractor should be prepared to excavate and remove oversize material (cobbles and boulders) in the courser alluvium and perhaps rubble within the BNSF embankment fill. Rubble, if encountered, should be removed and properly disposed of off-site.

Clearing and Grubbing

The existing ground surface along the project area is typically vegetated or covered in railroad ballast. Significant clearing and grubbing is not expected with the current improvements as planned, and these activities are expected to be limited to the removal of existing vegetation.

The work area should be cleared of all surface and subsurface deleterious matter, including debris, trees, shrubs and associated stumps and root wads, and should be stripped of any sod and organic soil. The woody debris should be removed from the project site for disposal.

Removal and demolition of existing structures should include removal of below-grade elements. Existing voids or new depressions created during site preparation should be cleaned of loose soil or debris and backfilled with structural fill.

Pavement and embankment areas along the alignment should be cleared and grubbed in accordance with Section 2-01 of the WSDOT Standards.

Erosion and Sedimentation Control

Potential sources or causes of erosion and sedimentation depend upon construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The project's impact on erosion-prone areas can be reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable City and/or county standards. The plan should incorporate basic planning principles including:

- Scheduling grading and construction to reduce soil exposure;
- Retaining existing vegetation whenever feasible;
- Revegetating or mulching denuded areas;
- Directing runoff away from denuded areas;
- Minimizing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Confining sediment to the project site;
- Inspecting and maintaining control measures frequently;
- Covering soil stockpiles; and
- Implementing proper erosion control BMPs.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce the potential for erosion and reduce transport of sediment to adjacent areas. Temporary erosion protection should include the construction of a silt fence around the perimeter of the work area prior to the commencement of grading activities. Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting.

Until the permanent erosion protection is established and the site is stabilized, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures and repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

Subgrade Preparation

Prior to the placement of new fill, subgrade areas should be proof-rolled to locate areas of loose, soft or pumping soils. Proof-rolling can be completed using a piece of heavy tire-mounted equipment or a loaded dump truck. If soft or pumping soils are observed, such unsuitable subgrade soils should be recompacted or overexcavated and replaced. The depth of overexcavation should be determined by the Geotechnical Engineer.

If deep pockets of soft or pumping soils are encountered, it may be possible to limit the depth of overexcavation by placing a construction geotextile for separation/soil stabilization (WSDOT Standard Specification 9-33) on the overexcavated subgrade and covering the geotextile with structural fill. The geotextile will provide additional support by bridging over the soft material, and will help reduce fines contamination into the structural fill. The need for geotextile fabric and overexcavation should be evaluated by the Geotechnical Engineer.

The Geotechnical Engineer should observe the subgrade preparation operations to help determine the depth of removal of soft or pumping soils, and to evaluate whether subgrade disturbance or progressive deterioration is occurring. Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during proof-rolling or compaction, it may become necessary to modify the proof-rolling or compaction criteria or methods.

Structural Fill

Materials

Materials used to construct roadways and embankments, backfill utility trenches, vaults or other structures are classified as structural fill for the purpose of this report. Structural fill material quality varies depending upon its use, as described below:

1. As a minimum, structural fill placed to construct embankments and roadways and to backfill utility trenches, vaults or other structures should meet the criteria for common borrow, WSDOT 9-03.14(3). Common borrow will be suitable for use as structural fill during dry weather conditions only. The existing railroad embankment fill generally qualifies as common borrow. If structural fill is placed during wet weather, the structural fill should consist of gravel borrow, WSDOT 9-03.14(1).
2. Structural fill placed below foundation elements should consist of gravel borrow (WSDOT Standard Specification 9-03.14(1)) or Class A or B foundation material (WSDOT Standard Specification 9-03.17).

3. Structural fill placed immediately outside the drainage zone of below-grade and retaining walls should consist of gravel backfill for walls in conformance with Section 9-03.12(2) of the WSDOT Standard Specifications.
4. Pipe bedding placed to surround utility pipe should meet the criteria for gravel backfill for pipe zone bedding, WSDOT Standard Specifications Section 9-03.12(3).
5. Structural fill placed as crushed surfacing base course below pavements should conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

On-Site Soils

The near surface native on-site soils adjacent to the BNSF embankment and along the corridor generally contain a high percentage of fines (silt and clay) and/or organic matter and are highly moisture sensitive and not suitable for reuse as structural fill. These materials are capable of supporting the new connecting trail fill, provided they do not become disturbed during construction.

The railroad embankment fill generally qualifies as common borrow and can be used for structural fill; however, only during dry weather conditions. We recommend against using the embankment fill for structural fill during wet weather conditions.

The near surface alluvial peat, silt, and clay along Section C of the project corridor contain a high percentage of fines (silt and clay) and/or organic matter and are highly moisture sensitive and not suitable for reuse as structural fill.

Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. Structural fill should be placed in loose lifts not exceeding 1 foot in thickness. Each lift should be conditioned to the proper moisture content and compacted to the specified density before placing subsequent lifts. Structural fill should be compacted to the following criteria:

1. Structural fill in new embankment, pavement and roadway areas, including utility trench backfill, should be compacted in general accordance with Method B of Section 2-03.3(14)C of the WSDOT Standard Specifications.
2. Structural fill placed behind retaining walls should be compacted in general accordance with Method C of Section 2-03.3(14)C of the WSDOT Standard Specifications, with the exception that all layers within 5 feet of the back of walls should be compacted to 90 percent of the MDD in accordance with ASTM D 1557. Care should be taken when compacting fill near the back of walls to avoid over-compaction and hence overstressing the walls. We recommend that hand operated compaction equipment be used within 5 feet of the back of the retaining wall.
3. Structural fill placed below foundation elements should be compacted in general accordance with Method C of Section 2-03.3(14)C of the WSDOT Standard Specifications.
4. Structural fill placed as CRBC below pavements should be compacted in general accordance with Method C of Section 2-03.3(14)C of the WSDOT Standard Specifications.
5. Structural fill for permanent slopes should be compacted in general accordance with Method B of Section 2-03.3(14)C of the WSDOT Standard Specifications.

6. Non-structural fill, such as fill placed in landscape areas, should be compacted in general accordance with Method A of Section 2-03.3(14)C of the WSDOT Standard Specifications. In areas intended for future development, a higher degree of compaction should be considered to reduce the settlement potential of the fill soils.
7. Fill placed below porous pavements and LID components should be evaluated on a case by case basis depending on the design infiltration rate and function of the facility.

We recommend that monitoring of the placement of backfill be provided to observe that the required compaction criteria are being met, the proper materials are used for structural backfill and that the contractor is placing the material in appropriate lifts for the compaction equipment being employed.

Wet Weather Concerns

The near surface native on-site soils adjacent to the BNSF embankment and along the corridor generally contain a high percentage of fines (silt and clay) and/or organic matter and are highly moisture sensitive. Disturbance of exposed soils should be expected if earthwork is completed during periods of wet weather. For wet weather construction, we recommend that:

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area.
- Slopes with exposed soils should be covered with plastic sheeting or similar means of protection.
- The contractor should take necessary measures to prevent fill soils from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps, and grading.

Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical. The contractor must make sure that temporary erosion and sedimentation measures also meet all requirements of the City of Redmond, and all other permitting agencies.

Temporary Slopes

We recommend that temporary unsupported cut slopes higher than 4 feet be inclined no steeper than 1½H:1V. This recommendation applies to the native soils and the embankment fill. This recommendation applies to fully dewatered conditions. Flatter slopes may be necessary if seepage is present on the cut face. Temporary cut slopes should encroach no closer than 5 feet laterally from roadways, pavements, structures or other improvements.

Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting, should be used to protect these slopes during periods of rainfall. Surface water runoff from above cut slopes must be prevented from flowing over the slope face by using curbs, berms, drainage ditches, swales or other appropriate methods.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slopes to maintain safe working conditions and protect adjacent facilities or structures. Slopes experiencing excessive sloughing or raveling can be flattened or can be regraded to add intermediate slope benches, or additional dewatering can be provided if the poor slope performance is related to groundwater seepage.

Permanent Slopes

We recommend that permanent unreinforced cut and fill slopes be constructed no steeper than 2H:1V. Steeper permanent fill slope inclinations can be achieved by reinforcing the fill with geogrids. If the geogrids extend only to the face of the slope, the slope can be inclined at a maximum steepness of 1½H:1V. Steeper fill slope face inclinations can be achieved by wrapping the geogrid around the outer face of the fill lifts (burrito wrap) or by introducing a facing element at the outer face of the fill lifts.

To achieve uniform compaction, we recommend that unreinforced fill slopes be overbuilt slightly (1 foot) and subsequently cut back to expose properly compacted fill. We recommend that the finished slope faces be compacted by track walking with the equipment running perpendicular to the slope contours so that the track grouser marks help provide an erosion-resistant slope texture. Reinforced fill slopes without facing wraps or facing elements should also be track walked if feasible; however, care should be exercised to avoid damaging the reinforcement material.

To reduce erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Until the vegetation is established, some sloughing and raveling of the slopes should be expected. This may require localized repairs and reseeding. Temporary covering, such as clear heavy plastic sheeting, jute fabric, loose straw, or excelsior or straw/coconut matting should be used to protect the slopes during periods of rainfall.

Settlement Considerations

Current plans call for minimal grading along the planned trail alignment. However, up to 1½ feet of new fill will be required (at the trail centerline) at the east and west abutments of the Sammamish River crossing and up to 4 feet of new fill will be required where the trail intersects driveways and roads along Willows Road. Compressible fine grained alluvial deposits, including layers of diatomaceous earth and/or peat are present below existing railroad alignment fill in Sections A and C of the project. We anticipate that up to 1 to 2 inches of settlement may occur in these sections where new fill is placed. To mitigate the potential for damage of new pavements and utilities, we recommend that, where 1 foot or more of fill is required in Sections A or C, it be placed prior to installing new utilities and at least 6 weeks prior to final paving.

Retaining Wall Design Considerations

General

We understand that short retaining walls, on the order of 2 to 5 feet high, will be incorporated to achieve grade changes, as needed, along the project corridor. Numerous suitable wall types can be designed for the project; however, based on our current understanding of the project, modular block walls, concrete cantilever walls, and/or MSE walls are anticipated to be the most cost-effective.

Parameters for MSE Wall Design

MSE walls consist of alternating layers of backfill soil and reinforcing material with facing elements. Commonly used reinforcing elements include steel strips and geosynthetic products such as geogrid and geotextile sheets. We understand the MSE walls will be designed by others. In the sections below, we provide recommended soil parameters and reinforcement considerations to be used in the wall design.

MSE walls should be designed in accordance with the AASHTO LRFD Bridge Design Manual and the WSDOT GDM.

Soil Parameters

We recommend the design parameters summarized below in Table 6 be used for design of the proposed MSE retaining walls. The values shown below assume the backfill soils in the reinforced zone and the retained soil behind the reinforced zone are compacted to at least 95 percent of the MDD in accordance with Method C, Section 2-03.3(14)C of the WSDOT Standard Specifications. Wall backfill within the reinforced zone should consist of gravel borrow as described in Section 9-03.14(1) of the WSDOT Standard Specifications or CSBC as described in Section 9-03.9(3) of the WSDOT Standard Specifications.

TABLE 6. RECOMMENDED DESIGN PARAMETERS FOR MSE WALLS

Soil Properties	Wall Backfill: Gravel Borrow WSDOT 9-03.14(1)	Retained Soil (Existing Fill)	Foundation Bearing Soil (Existing Fill)
Unit Weight, γ (pcf)	135	125	125
Friction Angle (deg)	36	34	34
Cohesion, c (psf)	0	0	0
Allowable Bearing Capacity (psf) – AASHTO Group I	N/A	N/A	3,000
Allowable Bearing Capacity (psf) – AASHTO Group VII	N/A	N/A	4,000

Notes:

References for gravel borrow and common borrow are to 2012 WSDOT Standard Specifications Section 9-03.14.

pcf – pounds per cubic foot

deg – degrees

psf – pounds per square foot

Minimum Embedment

The design heights of the MSE walls should include the above-ground wall heights as well as the full embedment depths of the walls. MSE wall embedment will be governed by the minimum AASHTO required embedment depths presented in Table 7.

TABLE 7. MINIMUM EMBEDMENT DEPTHS FOR MSE WALLS

Slope in Front of Wall	Minimum Embedment Depth[1] (feet)
Horizontal	H/20 or 2 feet, whichever is greater
3H:1V	H/10 or 2 feet, whichever is greater
2H:1V	H/7 or 2 feet, whichever is greater
1.5H:1V	H/5 or 2 feet, whichever is greater

Notes:

[1] H equals the retained wall height

AASHTO requires that walls with sloping ground in front of the wall be designed to include a 4-foot minimum width horizontal bench between the face of wall and the fore-slope for maintenance purposes. Since the retaining walls are not supporting vehicle traffic, this requirement may be waived with concurrence by the City of Redmond.

Wall Surcharges

We recommend an aerial surcharge load of 250 pounds per square foot (psf) to model traffic loading, if necessary.

Other Requirements

MSE walls should be designed with a FOS of 1.5 for sliding and pullout of reinforcing elements, and a FOS of 2 for overturning. If proprietary wall systems are used, the wall supplier is responsible for evaluating these items. However, we recommend that proprietary wall system designs be reviewed by a qualified geotechnical engineer to verify that valid assumptions were made relative to material properties and other factors.

The MSE walls should be designed for seismic loading as discussed in the "Earthquake Engineering" section of this report. In accordance with the WSDOT GDM, MSE walls that are free to translate or move during a seismic event should be designed with a reduced coefficient of horizontal acceleration (k_h) of approximately one-half of the PGA for the site. This corresponds to a coefficient of horizontal acceleration of 0.182g for walls in Segments A and C and 0.20g for walls in Segment B. Alternatively, the value of the horizontal coefficient of acceleration can be calculated using the Mononobe-Okabe method specified in Article 11.6.5 of the AASHTO LRFD Bridge Design Specifications. The vertical coefficient of acceleration (k_v) should be set to 0 for the analysis. For internal stability, the MSE wall design for pullout, reinforcement capacity and connection should consider a PGA of 0.364g for walls in Segments A and C and 0.40g for walls in Segment B.

Modular Block or Concrete Cantilever Retaining Walls

Modular block and gravity walls may be used for cut and fill slope wall segments where the wall configuration (height, width, temporary backcut, etc.) can be feasibly constructed. These wall systems act as gravity retaining structures. Construction of this type of wall requires a base width approximately equal to 60 percent of the wall height, and this type of wall usually has a slight face batter. The walls are backfilled with compacted granular soil. These walls should be designed with back drainage as discussed in the "Wall Drainage" section below. The required temporary cut slope and width of the structures should be considered in planning and design. All temporary backcuts should be made in accordance with the "Temporary Slopes" section of this report.

Modular block and gravity walls consist of stacked solid or hollow rectangular facing elements, typically rectangular concrete blocks of varying sizes. These blocks typically incorporate a locking groove or shear key to provide structural integrity and wall batter. The lowest level of the blocks should be founded in firm soils, with crushed rock base course used as a leveling course. The lowest row of blocks should be set at least 6 inches below the lowest adjacent grade, or have a minimum embedment depth based on the wall height as shown in Table 7, whichever is greater. The face of the wall is typically battered 3 to 5 degrees, and a drainage system should be provided behind the base of the block wall to prevent buildup of hydrostatic pressures.

Modular block and gravity walls should be designed in accordance with the AASHTO LRFD Bridge Design Specifications and the WSDOT GDM. We recommend the design parameters provided in Table 8 for use in design of WSDOT proprietary modular block wall systems.

TABLE 8. RECOMMENDED DESIGN PARAMETERS FOR MODULAR (GRAVITY) BLOCK WALLS

Soil Property	Wall Backfill: Gravel Borrow WSDOT 9-03.14(1)	Retained Soil: Native Soils/Common Borrow: WSDOT 9-03.14(3)	Foundation Bearing Soil: Native Soils/Structural Fill
Unit Weight (pcf)	135	125	125
Friction Angle (degrees)	36	34	34
Cohesion (psf)	0	0	0

Notes:

References for gravel borrow and common borrow are to 2012 WSDOT Standard Specifications Section 9-03.14.

For design of non-proprietary retaining walls, the soil properties presented in Table 8 may be used in conjunction with the lateral earth pressures summarized in Table 9.

TABLE 9. RECOMMENDED EARTH PRESSURE PARAMETERS FOR NON-PROPRIETARY RETAINING WALLS

Parameter	Value		
Back Slope:	Level	3H:1V	2H:1V
Active Earth Pressure [1]	33 pcf	41 pcf	47 pcf
Seismic Earth Pressure – Sections A and C[2,3]	7.5H psf	14H psf	28H psf
Seismic Earth Pressure – Section B[2,3]	8.5H psf	16H psf	28H psf
Fore Slope:	Level	3H:1V	2H:1V
Unfactored Passive Earth Pressure [1,4]	665	290	200
Wall Foundation Coefficient of Sliding – Unfactored	0.67		

Notes:

[1] Equivalent /Fluid Density – triangular pressure distribution

[2] H equal the retained wall height

[3] Rectangular pressure distribution

[4] Passive pressure reduced to account for seismic condition

The values shown in the Tables 8 and 9 assume that the backfill soil is compacted as recommended in the "Earthwork" section of this report and that drainage is provided as discussed in the "Wall Drainage" section. We recommend that the upper 2 feet of passive resistance be ignored. If soils adjacent to retaining wall footings are disturbed during construction, the disturbed soils must be recompacted or removed and replaced with adequately compacted structural fill; otherwise, the lateral passive resistance value must be reduced.

For traffic loading, we recommend that retaining walls be designed for traffic surcharge by increasing the apparent wall height by 2 feet. Where large surcharge loads, such as those from heavy trucks, cranes, or other construction equipment, are anticipated in close proximity to the retaining walls, the walls should be

designed to accommodate the additional lateral pressures resulting from these concentrated loads, on a case by case basis.

Modular block and gravity walls should be designed for seismic loading in accordance with accordance with the "Earthquake Engineering" section of this report. In accordance with the WSDOT GDM, walls that are free to translate or move during a seismic event should be designed with a reduced coefficient of horizontal acceleration (k_h) of approximately one-half of the PGA for the site. This corresponds to a coefficient of horizontal acceleration of 0.182g for walls in Segments A and C and 0.20g for walls in Segment B. Alternatively, the value of the horizontal coefficient of acceleration can be calculated using the Mononobe-Okabe method specified in Article 11.6.5 of the AASHTO LRFD Bridge Design Specifications. The vertical coefficient of acceleration (k_v) should be set to 0 for the analysis. The seismic earth pressures presented in Table 9 were developed in accordance with the WSDOT GDM.

For non-proprietary walls, the passive resistance may be computed using the unfactored (nominal) passive pressures presented in Table 9. The appropriate resistance factors for passive resistance and sliding resistance are shown in Table 10.

TABLE 10. RETAINING WALL RESISTANCE FACTORS

Limit State	Passive Resistance to Sliding	Shear Resistance to Sliding
Strength	0.5	0.8
Service	1.0	1.0
Extreme	0.9	0.9

The foundation subgrade for the modular block and gravity walls should be prepared in accordance with the recommendations provided in the "Earthwork" section of this report. We recommend that the condition of all wall foundation excavations be observed by the geotechnical engineer to evaluate whether the work is completed in accordance with our recommendations and whether the subsurface conditions are as expected. If the foundation subgrade for the modular block and gravity walls is adequately prepared, we anticipate that differential settlement along 100 linear feet of the wall will be less than about 1 inch. Recommendations for bearing capacity are provided in the "Bearing Capacity and Settlement" section of this report.

Bearing Capacity and Settlement

The bearing capacity for Strength, Service and Extreme Limit loading states for retaining walls are presented in Figure 3. We estimate that post-construction settlement of footings that are underlain by competent fill (existing or newly placed) or glacially consolidated soil, and are designed and constructed as recommended will be on the order of 1 inch or less, with differential settlement along 100 linear feet of the wall less than about 1 inch. Most of this settlement will occur rapidly as loads are applied. If unsuitable soils are exposed at the footing subgrade these materials should be removed and replaced as described in the "Subgrade Preparation" section of this report.

Wall Drainage

Positive drainage should be provided behind concrete walls, MSE walls and modular (gravity) block walls.

Wall drainage for MSE walls constructed using gravel borrow (WSDOT Standard Specifications Section 9-03.14(1)) in the reinforced zone can be completed by placing a perforated drainpipe with a minimum diameter of 4 inches at the back of the reinforced zone enveloped within a minimum thickness of 6 inches of gravel backfill for drains (WSDOT Standard Specifications Section 9-03.12(4)). A construction geotextile for underground drainage, moderate survivability, conforming to Section 9-33 of the WSDOT Standard Specifications should be placed around the gravel backfill for drains to prevent movement of fine soils into the drainage backfill.

For concrete and modular block walls, drainage should be provided by placing a 2-foot-wide zone of gravel backfill for walls (WSDOT 9-03.12(2)) against the rear face of the wall and draining the gravel with a 4-inch-diameter perforated pipe enveloped within a minimum thickness of 6 inches of gravel backfill for drains (WSDOT Standard Specifications Section 9-03.12(4)). A construction geotextile for underground drainage, moderate survivability, conforming to Section 9-33 of the WSDOT Standard Specifications should be placed around the gravel backfill for drains to prevent movement of fine soils into the drainage backfill. Alternatively, the perforated pipe may be substituted with through weepholes. Weepholes should be in accordance with the WSDOT Standard Plans and Section 6-02.3(21) of the WSDOT Standard Specifications.

We recommend using either heavy-wall pipe (SDR-35 PVC) or rigid corrugated polyethylene pipe (ADS N-12, or equal) for the collector pipe. We recommend against using flexible tubing for wall drain pipe. The pipes should be laid with a minimum slope of ½ percent and discharge into the stormwater collection system to convey the water to a suitable disposal location. The pipe installations should include cleanouts to allow for future maintenance.

Permanent drainage systems should intercept surface water runoff at the top and/or bottom of cut and fill slopes to prevent it from flowing in an uncontrolled manner across the walls.

Culvert Recommendations

General

A new culvert is proposed at Station 65+00 to accommodate Willows Creek. Based on the 95 percent design drawings, the culvert will be a 6-foot-high, 12-foot-wide aluminum arch culvert and will be replacing an existing 24-inch concrete culvert. The new culvert can be installed using open cut construction, within a sloped excavation, or using a shored excavation, and will be founded on concrete strip footings that run along the length of each arch.

Because the new culvert is proposed at the same location as the current culvert, bypass piping will be required. Based on the 95 percent design drawings, excavation depths will be about 9 to 10 feet and will be sloped (not shored). We recommend the excavations be sloped and constructed as described in the "Temporary Slopes" section of this report. We anticipate that fine-grained alluvial deposits will be exposed at the base of the excavation. Based on observations from boring B-6-14, up to 10 feet of peat may be present near the foundation subgrade elevation. In our opinion, driven steel pipe piles are the most economical foundation solution for the culvert support. Design recommendations for pipe piles are provided in the "Driven Steel Pipe Piles" section of the report.

Groundwater was measured at a depth of approximately 18 feet in the monitoring well installed in boring B-6-14, but based on observations during drilling and previous geotechnical data, we anticipate that perched groundwater will be encountered below a depth of about 6 to 9 feet. All temporary cut slopes and shoring must comply with the provisions of Title 296 WAC, Part N, "Excavation, Trenching and Shoring." The contractor performing the work has the primary responsibility for the protection of workers and adjacent improvements.

Because the soils at the crossing are anticipated to consist mostly of fill and fine-grained alluvial deposits, we recommend that all excavations extending below groundwater depth be fully dewatered. Otherwise, excessive groundwater flow into excavations could cause lateral movement of the granular soils into the excavations, possibly destabilizing the excavations or causing excessive ground settlement adjacent to the excavations. Dewatering is discussed further below.

We anticipate that a sloped excavation is possible and we recommend that temporary cut slopes be constructed as described in the "Temporary Slopes" section of this report. If a shored excavation is proposed, please contact GeoEngineers for appropriate lateral earth pressures.

Dewatering

The purpose of this report section is to present geotechnical and hydrogeological data that will influence temporary construction dewatering and to describe in general terms various types of dewatering techniques that may be feasible at the Willow Creek culvert. Detailed dewatering designs for construction are not within our scope of services.

As discussed above, groundwater was measured at an approximate depth of 17½ feet (Elevation 26.7 feet) in nearby monitoring well B-6-14, completed for this study. Groundwater was also noted during drilling and in older/previous explorations near the new culvert location, at depths varying from about 6 to 9 feet. We recommend the groundwater level be maintained a minimum of 2 feet below the bottom of the excavation during construction or at a level necessary to stabilize the shoring or temporary slopes. The level will depend upon the dewatering method, the size of the excavation and other factors.

Based on the soil conditions and groundwater data collected during this study, we expect that groundwater can be controlled by open pumping using sump pumps.

The level of effort required for dewatering will depend to a great extent on the time of year during which construction is accomplished and the extent to which creek flow is successfully diverted around the excavation. Less seepage into the work areas should be expected if construction is accomplished in the late summer or early fall months, and correspondingly, more seepage should be expected during the wetter periods of the year. We recommend that construction be completed in the late summer or early fall months when the creek flow is typically at its lowest. In our opinion, this will result in significant cost savings for the dewatering.

The open pumping dewatering method involves removing water that has seeped into the excavation by pumping from a sump that has been excavated at one or both ends of the excavation or trench. Drainage ditches that are connected to the sump are typically excavated along the sidewalls at the base of the excavation or trench. The excavation for the sump(s) and the drainage ditches should be backfilled with gravel or crushed rock to reduce the amount of erosion and associated sediment in the water pumped from

the sump. In our experience, a slotted casing or perforated 55-gallon drum that is installed in the sump backfill provides a suitable housing for a submersible pump.

The amount of water removed from the excavation by open pumping should be minimized because of high turbidity levels. Temporary storage of dewatering effluent from the sumps in a settlement tank or basin may be required to meet discharge permit requirements and reduce sediment content prior to discharging the water to surface water courses.

Driven Steel Pipe Piles

Based on our analyses, driven steel pipe piles may be used for support of the culvert and steel staircases, as needed. We recommend that 3- to 4-inch-diameter driven steel pipe piles be installed using a pneumatic impact equipment capable of penetrating a sufficient depth to develop the design loads. McDowell Northwest Pile King of Kent, Washington has equipment capable of installing this type of pile. Allowable capacities of 12 kips and 20 kips (FOS of at least 2) can be assumed for 3- and 4-inch-diameter pipe piles, respectively. We estimate that total foundation settlements of less than ½ inch will develop for properly installed pipe piles. We recommend that a static load test be completed on at least one pipe pile to verify actual capacity and confirm refusal criteria. The load test should be completed in accordance with ASTM D1143-81.

The piles should be embedded 10 to 15 feet into the underlying coarse-grained alluvial deposits or recessional outwash deposits or until practical refusal criteria is achieved. The practical refusal criteria depends on the hammer weight and model and piles may extend deeper than 25 feet below the existing ground surface. For preliminary planning, we recommend that the pipe piles be driven to the practical refusal criteria listed in Table 11. Pile installation should be observed by a representative of GeoEngineers and the actual refusal criteria verified by the load test.

TABLE 11. PRACTICAL REFUSAL CRITERIA (3- AND 4-INCH PILES)

Hammer Weight	Refusal Criteria (sec/in)	Blows Per Minute
650 lbs	15 (3-inch pile)	550-1100
850 lbs	10 (3-inch pile) 16 (4-inch pile)	550-1100
1,000 lbs	10 (4-inch pile)	550-1100

Temporary Foundations for Bridge Falsework

Improvements to the superstructure of the existing Sammamish River bridge crossing are planned as part of the project. Upgrades are not planned for the existing bridge foundations, which we understand consist of 12 bents of timber piles.

Falsework supported at grade below the bridge deck may be required by the contractor to complete the superstructure improvements. Fine grained alluvial deposits were reported at grade near the east bank of the river in previous explorations, and loose/medium stiff fill underlain by fine grained alluvial deposits was observed in the boring completed near the west bank of the river.

We recommend that temporary shallow foundations for falsework be designed using an allowable bearing pressure of 1,500 psf for foundations bearing on existing granular fill. Where existing granular fill is present at the foundation subgrade elevation, it should be compacted with vibratory equipment prior to setting the foundation. Where cohesive soils or fine grained alluvial deposits are present, we recommend that 1 foot of soil below the subgrade be removed and replaced with compacted crushed rock.

Temporary shallow foundations may cause settlement of underlying soils, and, where placed near existing bridge timber pile foundations, may impose downdrag loads on the piles. Prior to installing falsework, the contractor should confirm that the downdrag loading from the falsework will not result in exceedance of the allowable capacity of adjacent timber piles. Table 12 presents downdrag loading imparted on 18-inch timber piles for various load and distance combinations for piles at the east and west bents. The distance, R, is measured from the center of the surcharge load to the edge of the timber pile.

TABLE 12. DOWNDRAG LOADS ON EXISTING 18-INCH TIMBER PILES

Adjacent Foundation Load	Estimated Downdrag Load Imparted on Single Pile from Adjacent Foundation at Distance, R			
	East Bridge Bents		West Bridge Bents	
	R = 4 feet	R = 8 feet	R = 4 feet	R = 8 feet
5 kips	2.8 kips	1.1 kips	3.6 kips	1.3 kips
10 kips	5.8 kips	2.3 kips	7.4 kips	2.8 kips
30 kips	17.8 kips	7.2 kips	22.7 kips	8.9 kips

Additional Geotechnical Services

Throughout this report, recommendations are provided where we consider additional geotechnical services to be appropriate. These additional services are summarized below:

- If more rapid infiltration rates than those recommended in this report are required for the project, we recommend completing additional explorations (test pits) at infiltration facility locations. The purpose of this is to complete PITs as recommended by the 2012 SWWMM and to better estimate estimated infiltration rates.
- The Geotechnical Engineer should be retained to review the final project plans and specifications when complete to confirm that our design recommendations have been implemented as intended.
- During construction, the Geotechnical Engineer should observe and evaluate the excavations, the suitability of subgrade soils, the suitability and the compaction of the backfill, wall placement and the installation of foundation elements. The purposes of the Geotechnical Engineers' construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix D, Report Limitations and Guidelines for Use.

LIMITATIONS

We have prepared this report for the exclusive use of the City of Redmond, Otak and other project team members for the RCC Phase II project in Redmond, Washington. The data should be provided to prospective contractors for their bidding or estimating purposes, but our report and interpretations should not be construed as a warranty of the subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix D titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

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FIGURES

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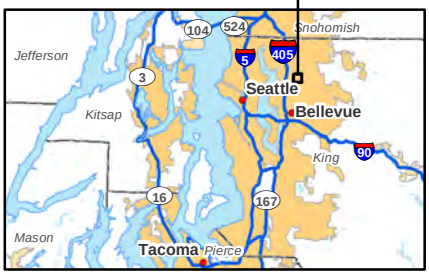

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Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Redmond Central Connector - Phase II
Redmond, Washington

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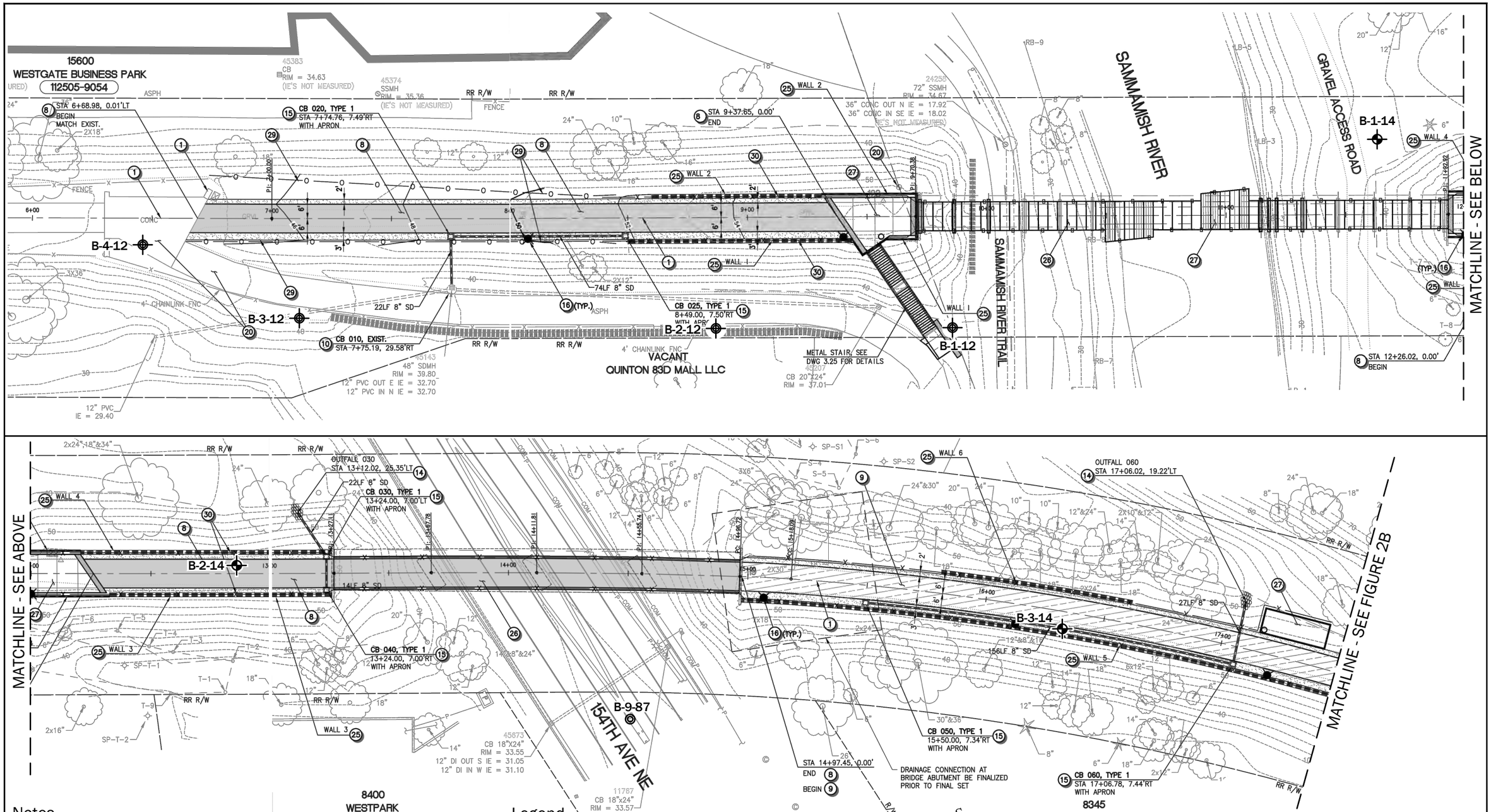
Figure 1

Office: RED Path: \\red\Projects\0\0500172\GIS\050017201_F1_VicinityMap.mxd Map Revised: 25 September 2013 cgonzales



Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

B-1-14	Boring by GeoEngineers (2014)
B-2-12	Boring by GeoEngineers (2012)
B-9-87	Boring by GeoEngineers (1987)
------50------	Existing Contours

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

GEOENGINEERS

Figure 2A

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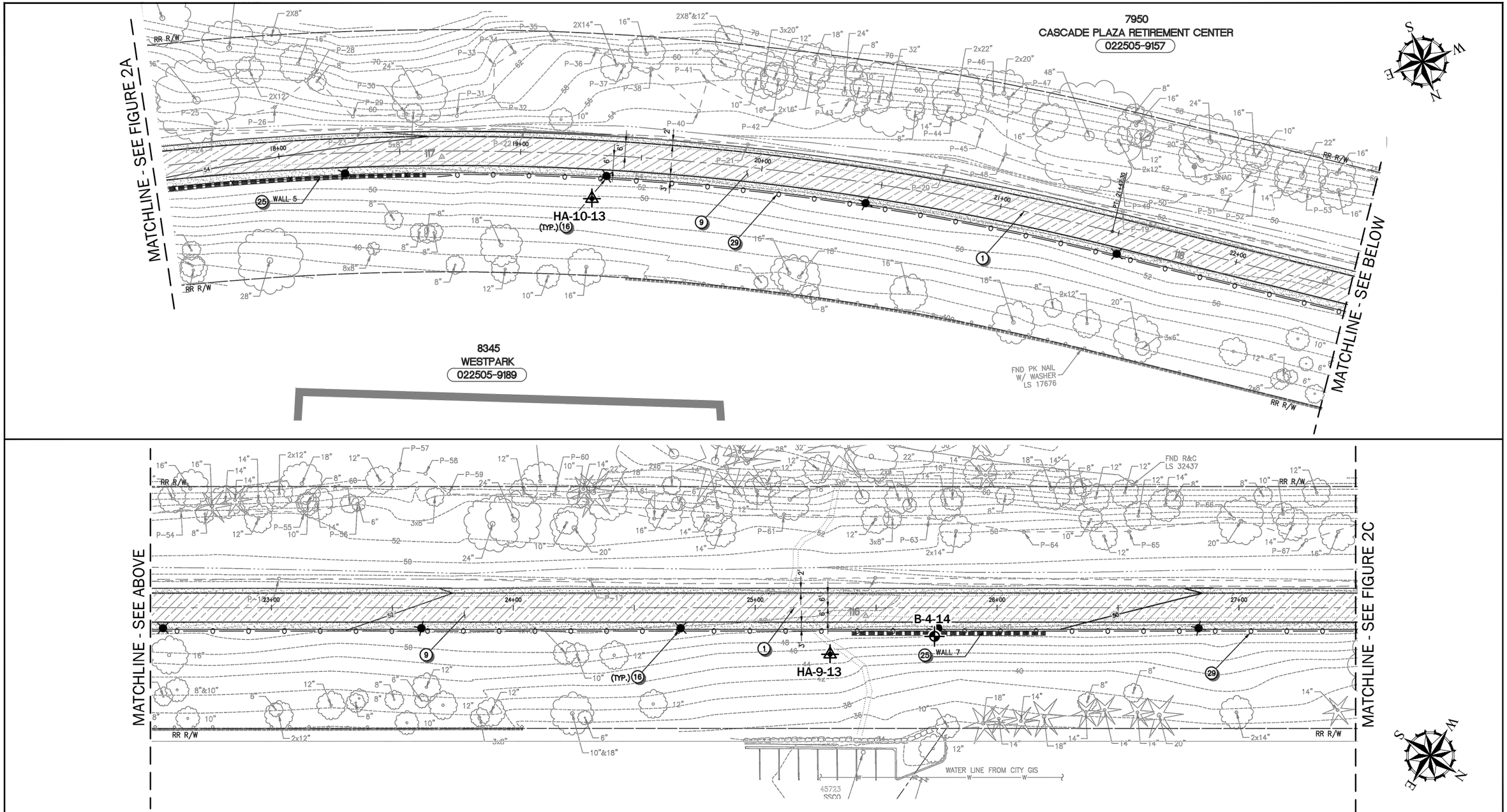

Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

B-4-14 — Boring by GeoEngineers (2014)

HA-9-13 — Hand Auger by GeoEngineers (2013)

50 — Existing Contours

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FEET

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

GEOENGINEERS

Figure 2B

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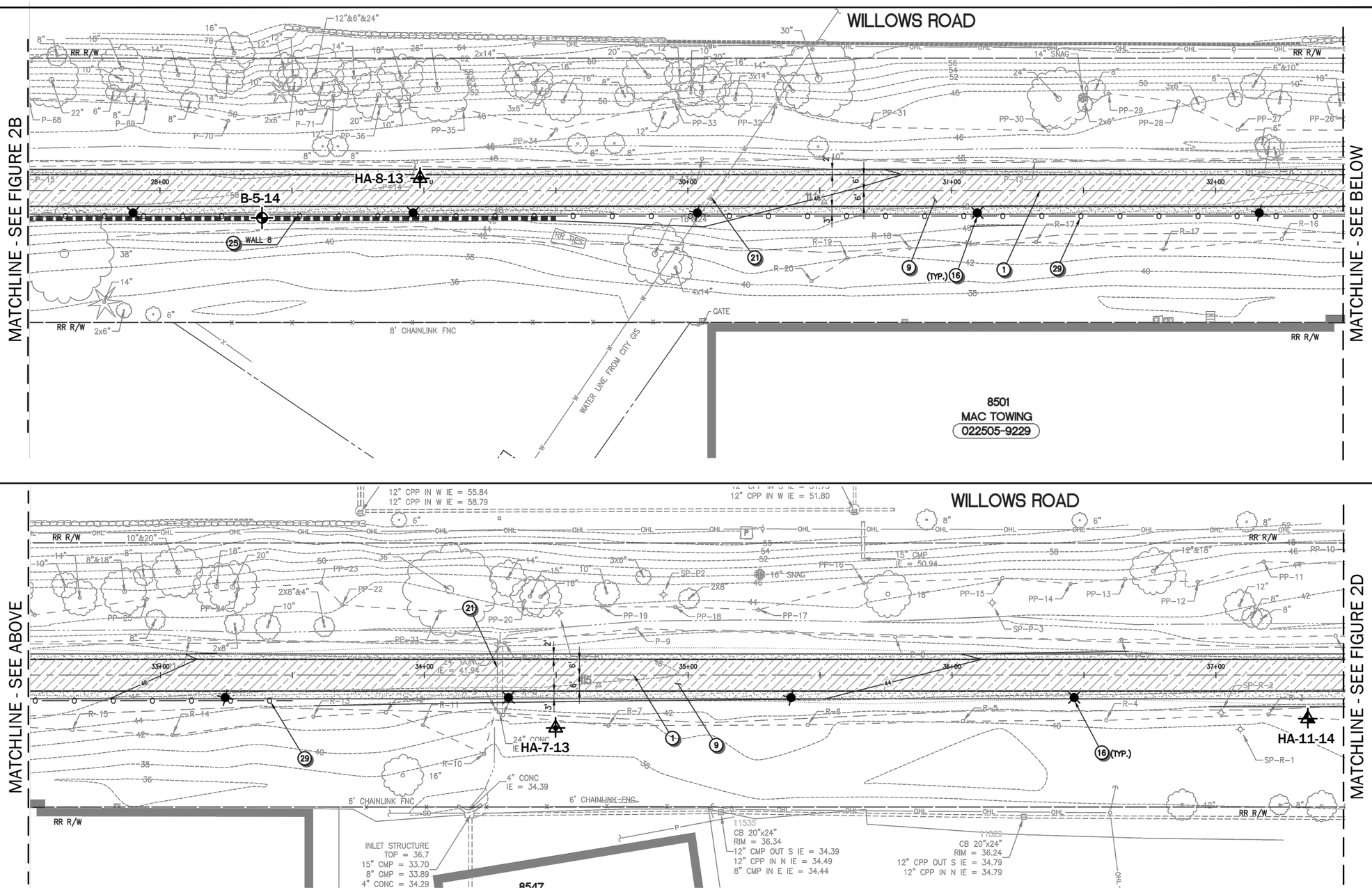

Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

B-5-14	Boring by GeoEngineers (2014)
HA-11-14	Hand Auger by GeoEngineers (2014)
HA-8-13	Hand Auger by GeoEngineers (2013)
------50------	Existing Contours

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FEET

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

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Figure 2C

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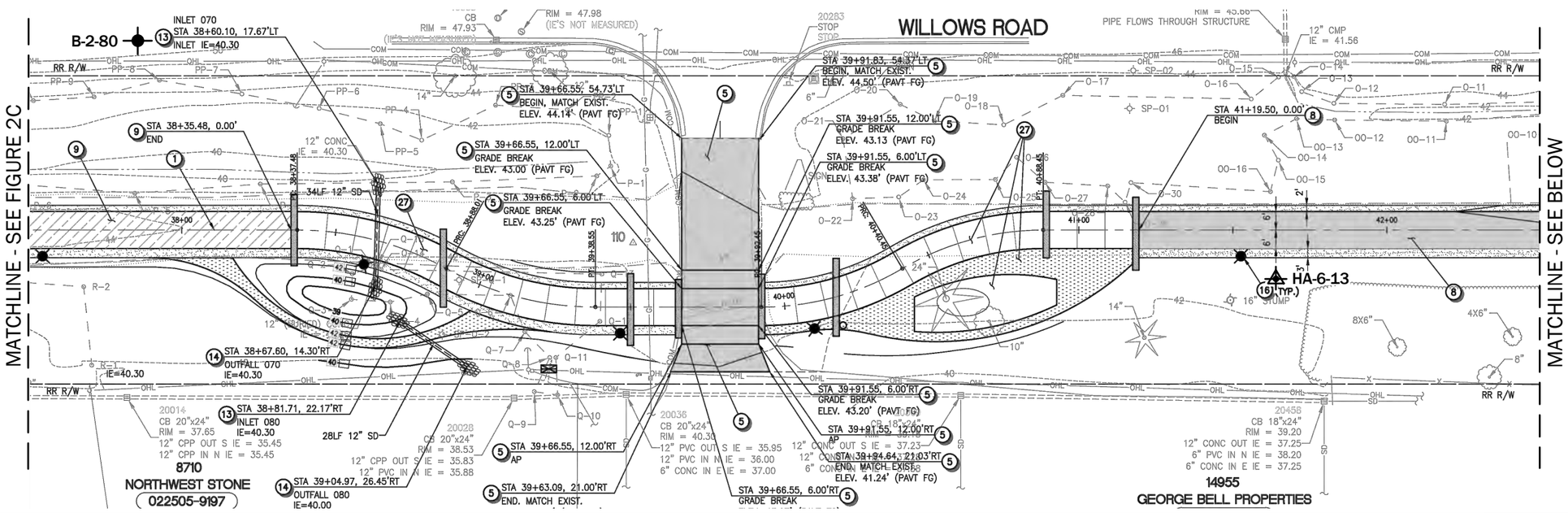

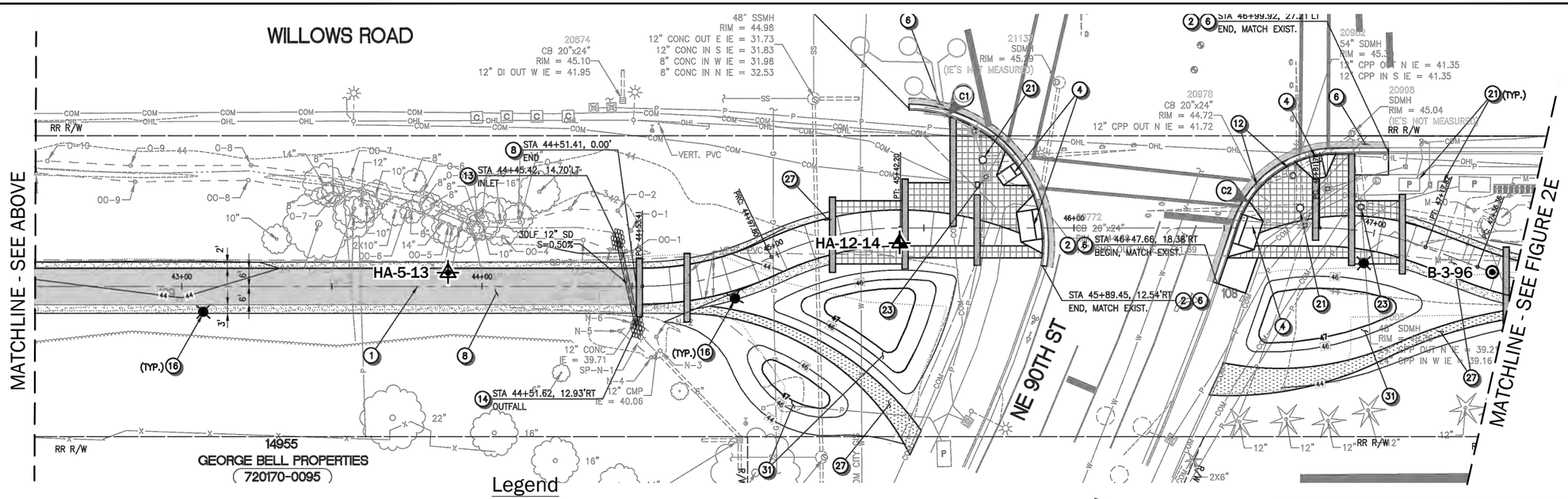

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

HA-12-14	Hand Auger by GeoEngineers (2014)
HA-6-13	Hand Auger by GeoEngineers (2013)
B-2-80	Boring by Others (1980)
B-3-96	Boring by GeoEngineers (1996)
50	Existing Contours

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FEET

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

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Figure 2D

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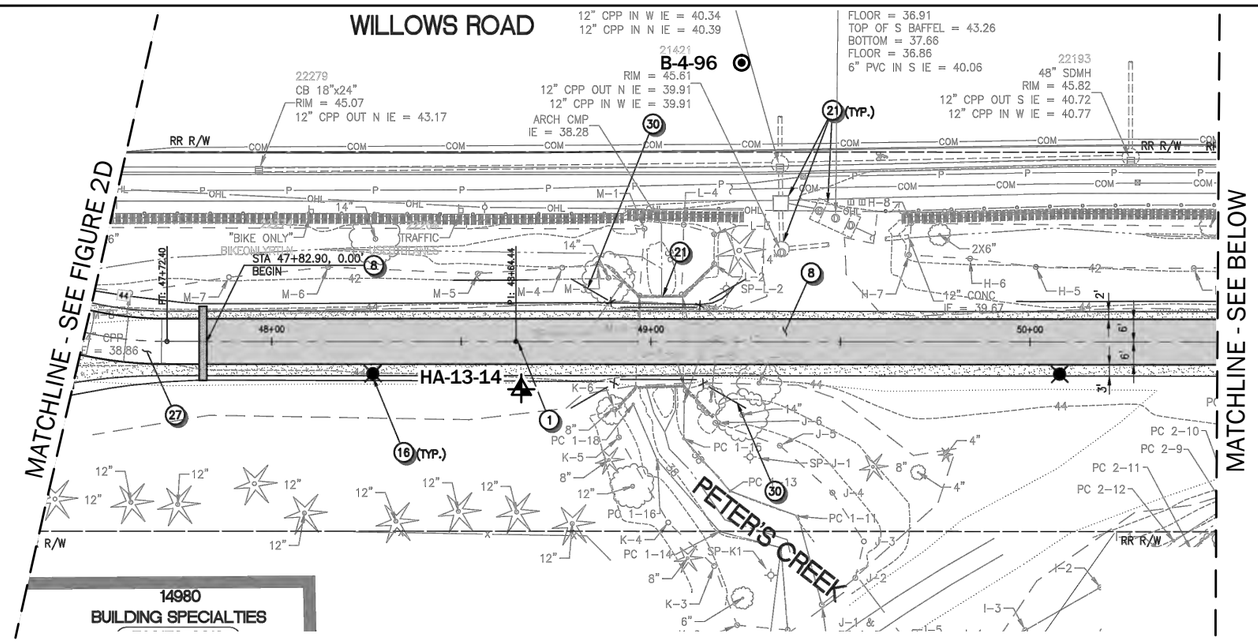

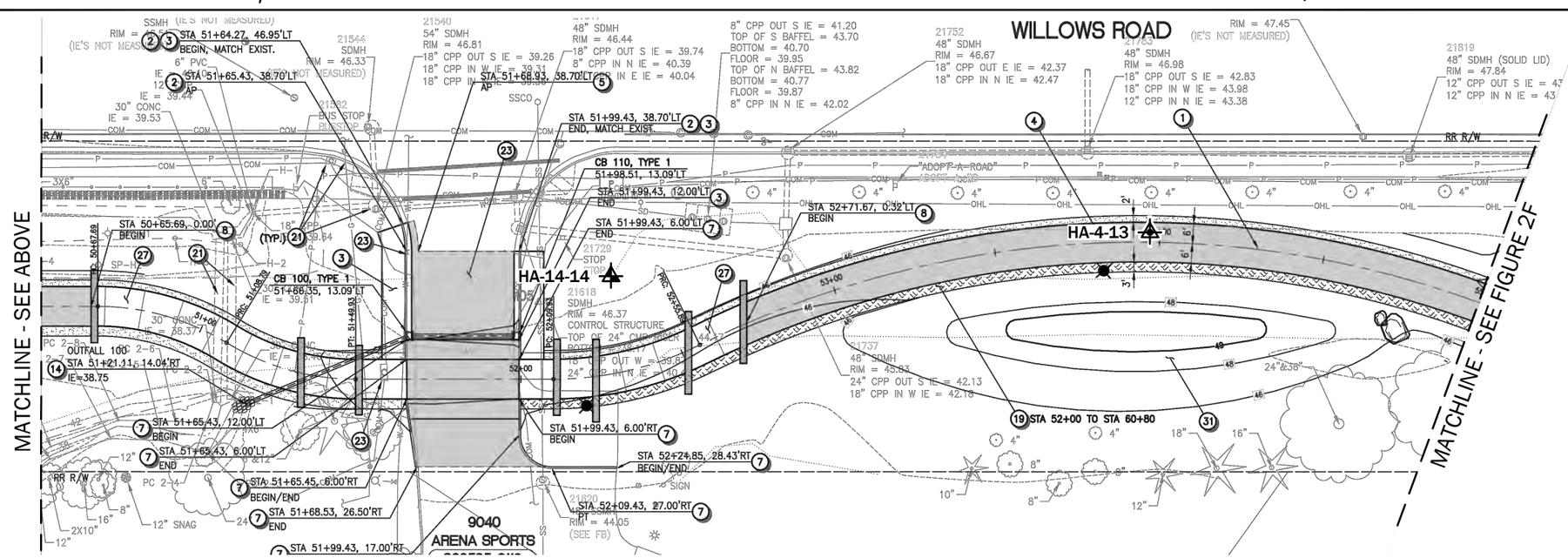

Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

HA-13-14	Hand Auger by GeoEngineers (2014)
B-4-96	Boring by GeoEngineers (1996)
HA-4-13	Hand Auger by GeoEngineers (2013)
50	Existing Contours

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FEET

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

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Figure 2E

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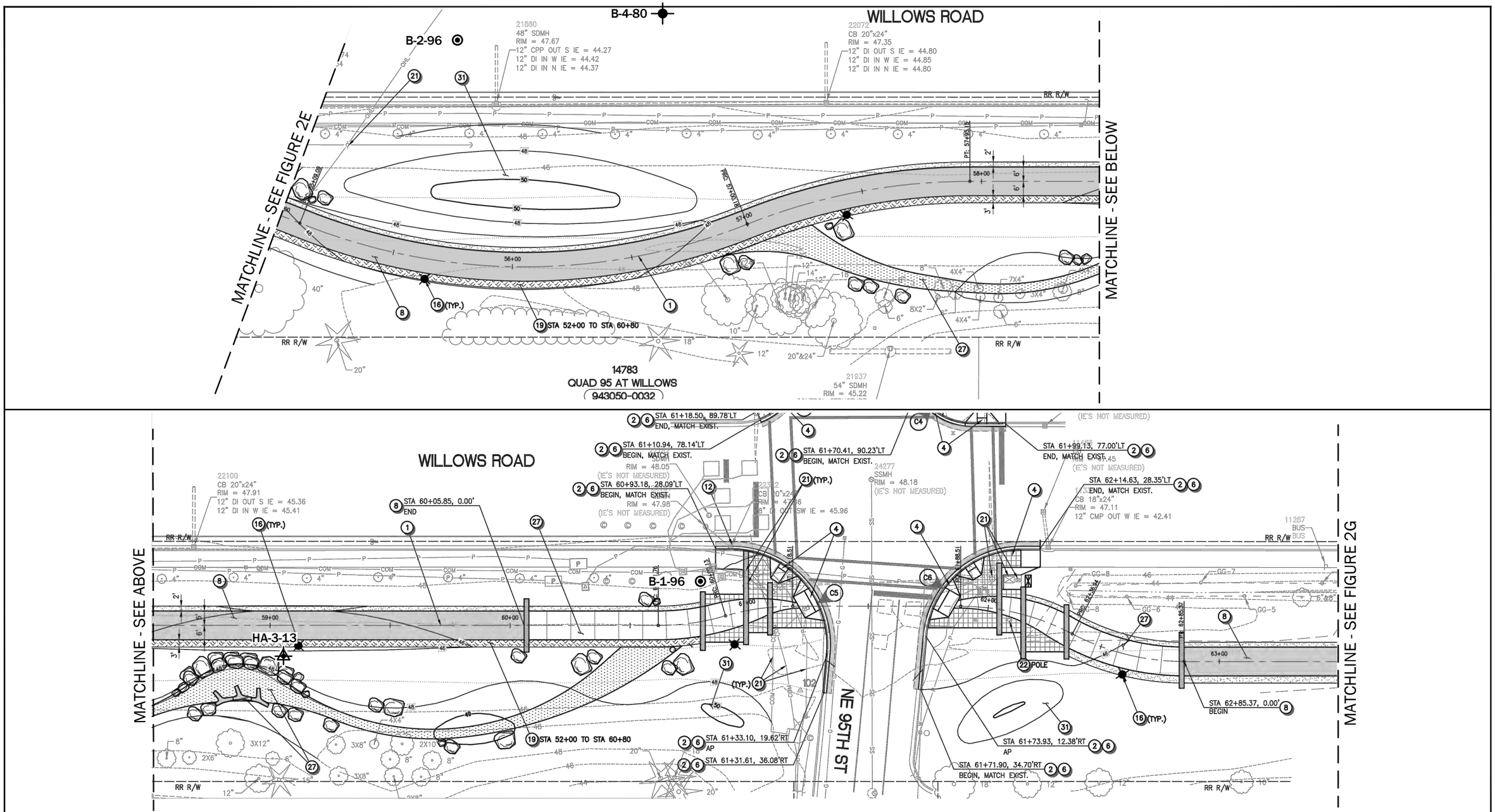

Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

HA-3-13	Hand Auger by GeoEngineers (2013)
B-4-80	Boring by Others (1980)
B-1-96	Boring by GeoEngineers (1996)
50	Existing Contours

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

GeoEngineers

Figure 2F

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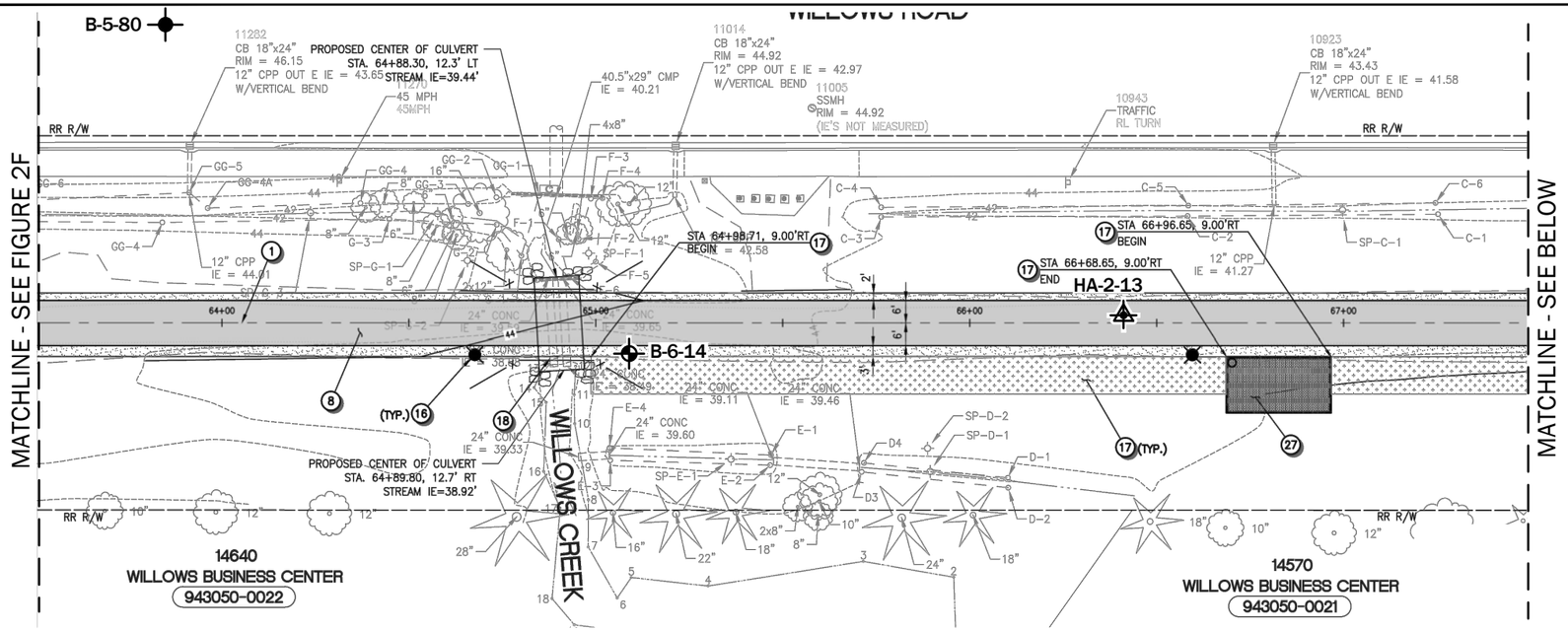

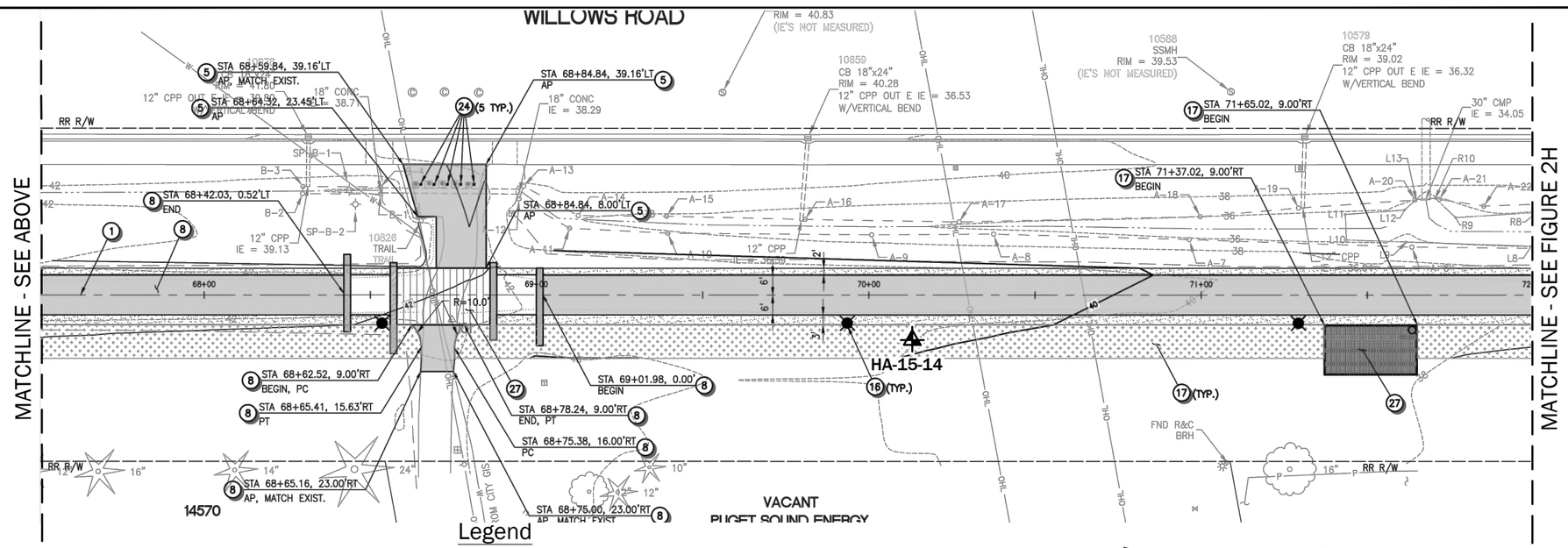

Notes

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Reference: Base drawings from 95% Design for the City of Redmond Central Connector Phase 2 by Otak dated April 2015.

Legend

B-6-14	Boring by GeoEngineers (2014)
HA-15-14	Hand Auger by GeoEngineers (2014)
HA-2-13	Hand Auger by GeoEngineers (2013)
B-5-80	Boring by Others (1980)
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FEET

Site Plan

Redmond Central Connector Phase II
Redmond, Washington

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Figure 2G

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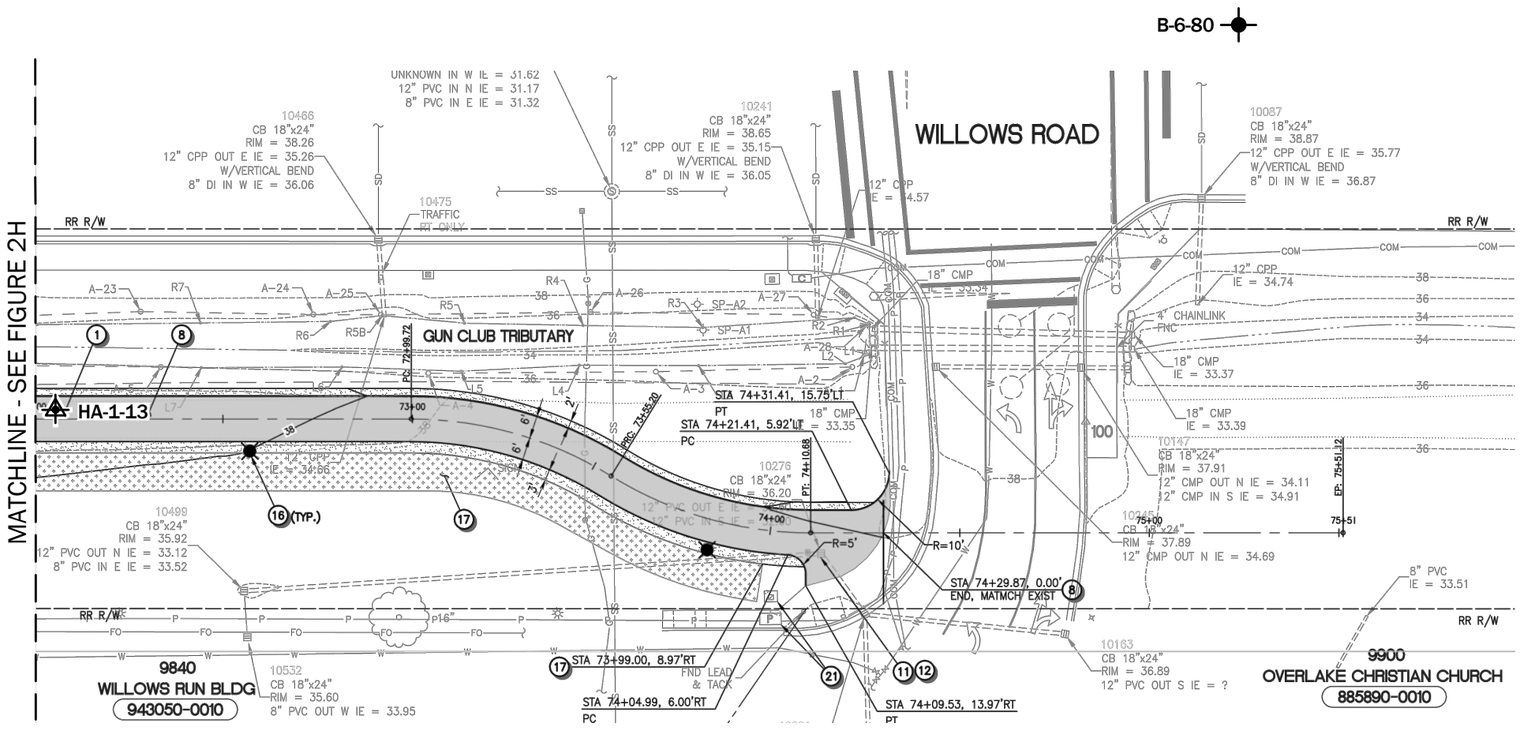

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Legend

HA-1-13 — Hand Auger by GeoEngineers (2013)

B-6-80 — Boring by Others (1980)

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Site Plan

Redmond Central Connector Phase II
Redmond, Washington

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Figure 2H

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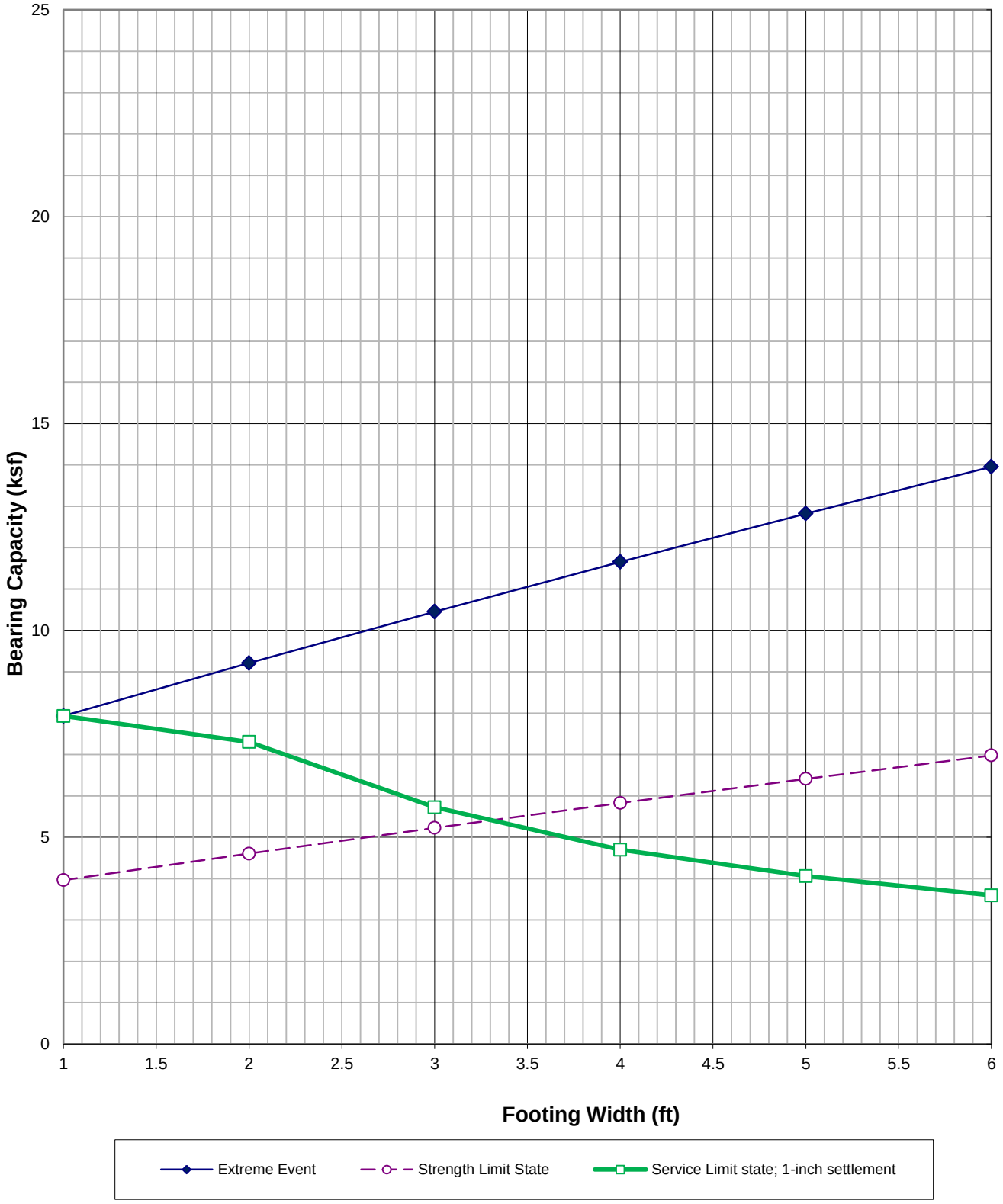
Bearing Capacity for Retaining Walls



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Retaining Wall Bearing Capacity

Figure 3

APPENDICES

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APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

General

Subsurface conditions at the site were explored by drilling six borings (B-1-14 through B-6-14) and completing a series of 15 hand-augered explorations (HA-1-13 through HA-10-13 and HA-11-14 through HA-11-15). The drilling of the borings was performed by Boretec, Inc. under subcontract to GeoEngineers on October 1 and October 16, 2014. The hand explorations were completed by GeoEngineers personnel using a manually operated sampling auger on September 11, 2013 and October 2, 2014.

The locations and elevations of the explorations were estimated by taping/pacing from existing site features. The approximate locations of the explorations are shown on the Site Plans, Figures 2A through 2H.

Borings

The borings were completed using an RCT-50 drill rig with continuous-flight, hollow-stem auger drilling equipment. The borings were continuously monitored by a geologist from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each exploration.

The soils encountered in the borings were sampled at 2½- or 5-foot vertical intervals with a 2-inch outside diameter split-barrel standard penetration test (SPT) sampler. The samples were obtained by driving the sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count ("N-value") of the soil was calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. Where very dense soil conditions precluded driving the full 18 inches, the penetration resistance for the partial penetration was entered on the logs. The blow counts are shown on the boring logs at the respective sample depths.

Soils encountered in the borings were visually classified in general accordance with the classification system described in Figure A-1. A key to the log symbols is also presented in Figure A-1. The logs of the borings are presented in Figures A-2 through A-7. The logs are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted. The densities noted on the boring logs are based on the blow count data obtained in the borings and judgment based on the conditions encountered.

Observations of groundwater conditions were made during drilling, and these observations represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site.

Monitoring Wells

One monitoring well was installed in boring B-6-14 to measure the groundwater level. The monitoring well consists of 2-inch polyvinyl chloride (PVC) well casing. The lower 10 feet of the well casing is slotted and then backfilled with 10-20 silica sand. The remaining backfill consists of bentonite chips. The well is protected with an at-grade monument. Details of the well installation are provided on the boring log. Groundwater level measurements in the monitoring well are provided in the report text.

Hand Auger Explorations

The hand auger explorations were completed by a representative from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions, and prepared a summary log of each hand exploration.

The hand auger explorations were completed using a manually operated sampling auger. The auger bucket is approximately 3 inches in diameter and 12 inches long and is extended into the ground using a series of extendable rods. The auger was advanced into the soil by hand and soil samples were collected as the excavation progressed.

Soils encountered in the hand auger explorations were visually classified in general accordance with the classification system described in Figure A-1. The logs of the hand auger explorations are presented in Figures A-8 through A-22. The logs are based on our interpretation of the field and laboratory data and indicate the various types of soils and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. The densities noted on the logs are based on difficulty in excavation and judgment based on the conditions encountered.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GEOENGINEERS

FIGURE A-1

Drilled Start 10/16/2014 End 10/16/2014	Total Depth (ft) 41.5	Logged By AL Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger
Surface Elevation (ft) 37 Vertical Datum NAVD88		Hammer Data Rope & Cathead 140 (lbs) / 30 (in) Drop		Drilling Equipment RCT-50
Easting (X) Northing (Y)		System Datum		Groundwater Date Measured / Depth to Water (ft) / Elevation (ft)

Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1			Sod	2 inches grass			
									SM	Brown silty fine to medium sand with gravel and organics (fine roots) (loose to medium dense, moist) (fill)			
35			18	5		2			SM	Gray with orange staining silty fine sand with organics (loose, moist)			
	5		18	8		3			ML	Gray with orange staining silt with occasional organics (fine roots) (medium stiff to stiff, moist to wet)			
30			18	2		4			Peat	Brown peat (very soft to soft, moist to wet) (fine-grained alluvial deposits)	161		
	10		13	10		5A 5B			SP	Gray fine sand (loose to medium dense, moist to wet)			
25			8	8		6			SM	Gray silty fine to medium sand with silt lenses (loose, wet)			
	15		18	2		7			CL	Gray clay (very soft to soft, wet)	33		
20													Groundwater observed at approximately 17 feet at the time of drilling
	20		18	21		8			SP	Gray fine to medium sand with gravel (medium dense, wet) (coarse-grained alluvial deposits)			Slight sheen observed
15													

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1-14

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-2
Sheet 1 of 2

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
							SP-SM	Gray fine to coarse sand with silt and gravel (medium dense, wet)			
	25	4	15	9							
	30	3	29	10			GP	Gray fine to coarse gravel with sand (medium dense, wet)			
							SP	Gray fine to coarse sand with occasional gravel (very dense, wet)			
	35	6	60	11							
	40	18	58	12			ML	Gray silt (hard, wet) (transitional beds)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1-14 (continued)

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-2
Sheet 2 of 2

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start 10/1/2014 End 10/1/2014	Total Depth (ft) 41.5	Logged By AL Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger
Surface Elevation (ft) 54 Vertical Datum NAVD88		Hammer Data Rope & Cathead 140 (lbs) / 30 (in) Drop		Drilling Equipment RCT-50
Easting (X) Northing (Y)		System Datum		Groundwater Date Measured / Depth to Water (ft) / Elevation (ft): None observed

Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0			1			GP-GM	Black fine to coarse gravel with silt and sand (loose, moist) (fill)			
		9	25	2			GP-GM	Brown fine to coarse gravel with silt and sand (medium dense, moist to wet)			
50							SM	Brown silty fine to coarse sand with gravel (medium dense, moist to wet)			
	5	2	29	3							
							SM	Light brown silty fine to coarse sand with gravel (medium dense, moist)			
		6	20	4 SA					5	21	
45							SM	Light brown silty fine to medium sand with occasional gravel (medium dense, moist)			
	10	5	14	5							
							ML	Brown silt with sand (very stiff, moist)			
		2	22	6							
40							SM	Brown silty fine to medium sand (medium dense, moist)			
	15	3	14	7 %F					9	36	
35							SM	Brown-gray with oxidation staining silty fine to medium sand with occasional organics (loose, moist)			
	20	10	7	8							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-2-14

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-3
Sheet 1 of 2

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
30											
	25	18	18	9			Peat	Dark brown peat (very stiff, moist to wet) (fine-grained alluvial deposits)			
				%F			SM	Gray silty fine sand (medium dense, moist to wet)	59	49	
25							CL	Gray sandy clay (medium stiff, wet)			Groundwater observed at approximately 29 feet during drilling
	30	18	6	10							
20							GP-GM	Gray fine to coarse gravel with silt and sand (medium dense, wet) (coarse-grained alluvial deposits)			
	35	12	22	11							
15											
	40		20	12							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-2-14 (continued)

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-3
Sheet 2 of 2

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start 10/1/2014	End 10/1/2014	Total Depth (ft) 16.5	Logged By AL / Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger
Surface Elevation (ft) 53 / Vertical Datum NAVD88		Hammer Data Rope & Cathead 140 (lbs) / 30 (in) Drop		Drilling Equipment RCT-50	
Easting (X) / Northing (Y)		System Datum		Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	None observed

Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1			GP-GM	Dark brown fine to coarse gravel with silt and sand (loose, moist) (fill)			
			3	55		2			GP-GM	Dark brown fine to coarse gravel with silt and sand (very dense, moist to wet)			
50									SM	Brown silty fine to coarse sand with gravel (medium dense, moist)			
	5		5	27		3 SA/HA					2	27	
			3	23		4			SM	Light brown silty fine to coarse sand with gravel (medium dense, moist)			
45													
	10		5	21		5 SA					5	23	
40									ML	Gray silt with occasional sand (very stiff, moist) (tranisitional deposits)			
	15		8	18		6							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-3-14

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-4
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled	Start 10/1/2014	End 10/1/2014	Total Depth (ft) 16.5	Logged By AL / Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger
Surface Elevation (ft) / Vertical Datum	49 / NAVD88		Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	RCT-50
Easting (X) / Northing (Y)			System Datum		Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	None observed

Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1			ML	Dark gray silt (hard, moist) (fill)			
			15	48		2 SA/HA			CL	Gray lean clay (hard, moist) (transitional beds)	18	87	
45													
	5		18	46		3 AL				Becomes moist to wet	17		AL (LL = 48, PI = 23)
			13	73		4							
40													
	10		18	59		5			CL	Gray lean clay (hard, moist to wet)			2-inch layer of compressed organics in sample
35													
	15		12	50/6"		6							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-4-14

GeoEngineers

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-5
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start 10/1/2014 End 10/1/2014	Total Depth (ft) 16.5	Logged By AL Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger
Surface Elevation (ft) 47 Vertical Datum NAVD88		Hammer Data Rope & Cathead 140 (lbs) / 30 (in) Drop		Drilling Equipment RCT-50
Easting (X) Northing (Y)		System Datum		Groundwater Date Measured / Depth to Water (ft) / Elevation (ft): None observed
Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.				

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1			GP-GM	Brown fine to coarse gravel with silt and sand (medium dense, moist) (fill)			
45			7	10		2 SA/HA			SM	Brown silty fine to medium sand (loose to medium dense, moist)	14	27	
	5		4	17		3 %F			SM	Light brown silty fine to medium sand with occasional gravel (medium dense, moist) (outwash deposits)	12	47	
40			6	34		4				Becomes dense			
	10		12	53		5 %F				Becomes brown, very dense	9	40	
35									ML	Gray silt (very stiff, moist) (tranisitional deposits)			
	15		18	18		6							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-5-14

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-6
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled	Start 10/1/2014	End 10/1/2014	Total Depth (ft) 21.5	Logged By AL / Checked By CEW	Driller Boretec	Drilling Method Hollow-Stem Auger

Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	RCT-50
Surface Elevation (ft) Vertical Datum	44.34 NAVD88	Top of Casing Elevation (ft)	44.14
Easting (X) Northing (Y)		Horizontal Datum	

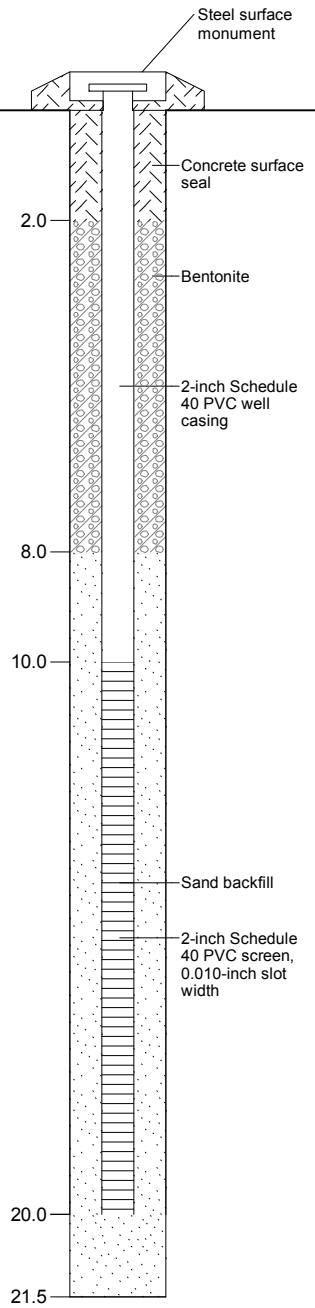
DOE Well I.D.: BIS102
A 2 (in) well was installed on 10/1/2014 to a depth of 20 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/16/2014	17.63	26.71

Notes: Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0								TS	3 inches topsoil		
						1			SM	Brown silty fine to medium sand with occasional gravel (loose, moist) (fill)		
			8	7		2						
40	5		18	6		3						
			9	11		4 %F			SM	Brown-gray silty fine to medium sand (medium dense, wet) (fine-grained alluvial deposits)	22	31
35										(Groundwater observed at approximately 9 feet during drilling)		
	10		0	6		5				No recovery Becomes loose		
30									Peat	Dark brown peat (medium stiff, wet)		
	15		18	5		6					226	
25												
	20		18	25		7						
									GP-GM	Gray fine to coarse gravel with silt and sand (medium dense, wet) (outwash deposits)		

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring B-6-14

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-7
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_GEOTECH_WELL

Date Excavated: 9/11/2013 | Logged By: CG

Equipment: Hand Auger | Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
38	1	X	1 SA		GP-GM		Brown fine to coarse gravel with silt, sand and trace organics (medium dense, moist) (fill)	5	%F = 7
37	2								
36	3								<1" probe penetration

Refusal at 3 feet.
No groundwater seepage observed.
Disturbed soil sample obtained at 1 foot.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-1-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-8
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 4.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					TS		Brown silty fine to medium sand with organics and gravel (medium dense, moist) (topsoil)		
42	1				SM		Brown silty fine to medium sand with trace organics (medium dense, moist) (fill)		
41	2								
40	3								
39	4	X	1 SA					13	%F = 20 <1" probe penetration

Hand auger completed at 4.5 feet.
No groundwater seepage observed.
Disturbed soil sample obtained at 4.5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-2-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-9
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: CG

Equipment: Hand Auger | Total Depth (ft) 5.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
45	1	X	1		SM		Gray silty fine sand with occasional gravel and organic matter (medium dense, moist) (fill)		
44	2	X	2						
43	3				ML		Gray-brown silt (medium stiff, moist) (fine-grained alluvial deposits)		
42	4	X	3						
41	5								1"-2" probe penetration

Hand auger completed at 5 feet.
No groundwater seepage observed.
Disturbed soil samples obtained at 0.5, 2 and 4 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-3-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-10
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 5.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
			1		SM		Brown silty fine to medium sand with gravel, cobbles and organics (dense, moist) (fill)		
46	1	X							
					SM		Brown silty fine sand with occasional gravel and trace organic matter (medium dense, moist)		
45	2	X	2						
44	3								
43	4				SM		Gray-brown silty fine to medium sand (medium dense, wet)		
42	5	X	3 SA					27	%F = 12 1"-2" probe penetration

Hand auger completed at 5 feet.
Groundwater seepage observed at 5 feet.
Disturbed soil samples obtained at 0.5, 2 and 5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-4-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-11
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 Logged By: ET

Equipment: Hand Auger Total Depth (ft) 1.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
47	1	X	1		TS		Brown silty fine to medium sand with gravel, cobbles and organics (medium dense, moist) (topsoil)		

Refusal on cobble at 1 foot.
No groundwater seepage observed.
Disturbed soil sample obtained at 0.5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-5-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-12
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 5.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					TS		Gray-brown silty fine to medium sand with gravel and organics (medium dense, moist) (topsoil)		
41	1				ML		Brown sandy silt (medium stiff, moist) (fine-grained alluvial deposits)		
40	2	X	1						
39	3								
38	4				CL		Gray-brown sandy lean clay (medium stiff, moist)		
37	5	X	2 AL					22	1"-2" probe penetration

Hand auger completed at 5 feet.
No groundwater seepage observed.
Disturbed soil samples obtained at 2 and 5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-6-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-13
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 Logged By: ET

Equipment: Hand Auger Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
	1	X	1 SA		SM		Grayish-brown silty fine sand with gravel (dense, moist) (fill)	10	%F = 37 <1" probe penetration

Refusal on cobble at 1.5 feet.
No groundwater seepage observed.
Disturbed soil sample obtained at 0.5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-7-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-14
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					CL		Gray-brown sandy clay with occasional gravel and organic matter (stiff, moist) (fill)		
47	1								
46	2	X	1 SA					25	%F = 66 <1" probe penetration
45	3								

Hand auger completed at 3 feet.
No groundwater seepage observed.
Disturbed soil sample obtained at 2 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-8-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-15
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 2.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
		X	1		TS		Dark brown silty fine to medium sand with organic matter and occasional gravel (loose, moist) (topsoil)		
45	1				SM		Brown silty fine to medium sand with occasional gravel (dense, moist) (fill)		
44	2	X	2 SA					15	%F = 46 < 1" probe penetration

Hand auger completed at 2.5 feet.
No groundwater seepage observed.
Disturbed soil samples obtained at 0.5 and 2.5 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-9-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-16
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 9/11/2013 | Logged By: ET

Equipment: Hand Auger | Total Depth (ft) 3.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
		X	1		TS		Dark brown silty fine to coarse sand with gravel and organic matter (medium dense, moist) (topsoil)		
	1								
		X	2 SA		CL		Brown-gray clay with sand and trace organic matter (hard, moist) (transitional beds)	26	%F = 74
	2								<1" probe penetration
	3								

Hand auger completed at 3 feet.
No groundwater seepage observed.
Disturbed soil samples obtained at 0.5 and 2 feet.

Note: See Figure A-1 for explanation of symbols.

Log of Hand Auger HA-10-13

GEOENGINEERS

Project: Redmond Central Connector Phase II
Project Location: Redmond, Washington
Project Number: 0500-172-02

Figure A-17
Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 10/2/2014 | Logged By: AL

Equipment: Hand Auger | Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					GP		4 inches of surface gravel (fill)		
41	1	X	1		GP-GM		Brown fine to coarse gravel with silt and sand (dense, moist)		<1" probe penetration
40	2	X	2 SA		SP-SM		Brown fine to coarse sand with silt and gravel (dense, moist)	6	<1" probe penetration

Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Log of Hand Auger HA-11-14

GEOENGINEERS

Project: Redmond Central Connector Phase II

Project Location: Redmond, Washington

Project Number: 0500-172-02

Figure A-18

Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 10/2/2014 Logged By: AL

Equipment: Hand Auger Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					GP		4 inches of surface gravel (fill)		
43	1	X	1 SA/HA		SM		Brown silty fine to coarse sand with gravel (dense, moist)	10	<1.5" probe penetration
42	2	X	2						<1" probe penetration

Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Log of Hand Auger HA-12-14

GEOENGINEERS

Project: Redmond Central Connector Phase II

Project Location: Redmond, Washington

Project Number: 0500-172-02

Figure A-19

Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 10/2/2014 Logged By: AL

Equipment: Hand Auger Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					GP		4 inches of surface gravel (fill)		
43	1	X	1		GP-GM		Brown fine to coarse gravel with silt and sand (medium dense, moist to wet)		
					SM		Brown silty fine to coarse sand with gravel (dense, moist)		
42	2	X	2 SA/HA					2	2" probe penetration

Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Log of Hand Auger HA-13-14

GEOENGINEERS

Project: Redmond Central Connector Phase II

Project Location: Redmond, Washington

Project Number: 0500-172-02

Figure A-20

Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\050017202.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 10/2/2014 Logged By: AL

Equipment: Hand Auger Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					GP		4 inches of surface gravel (fill)		
					GP		Brown fine to coarse gravel with sand (medium dense, moist)		
45	1	X	1						1" probe penetration
44	2	X	2 SA/HA		SM		Dark brown silty fine to coarse sand with gravel (dense, moist)	1	<1" probe penetration

Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Log of Hand Auger HA-14-14

GEOENGINEERS

Project: Redmond Central Connector Phase II

Project Location: Redmond, Washington

Project Number: 0500-172-02

Figure A-21

Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 10/2/2014 | Logged By: AL

Equipment: Hand Auger | Total Depth (ft) 2.0

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					GP		2 inches of gravel and grass (fill)		
					SM		Brown silty fine to coarse sand with gravel and occasional organics (medium dense, moist)		
39	1	X	1						
		X	2 SA/HA		SM		Dark brown silty fine to medium sand with gravel and occasional organics (medium dense, moist)	2	0.5" probe penetration
38	2								

Field screening consisting of sheen and odor testing was completed at each sample location. Except where noted in Remarks, no sheen or odor was observed.

Log of Hand Auger HA-15-14

GEOENGINEERS

Project: Redmond Central Connector Phase II

Project Location: Redmond, Washington

Project Number: 0500-172-02

Figure A-22

Sheet 1 of 1

Redmond: Date:11/3/14 Path:C:\USERS\KJANC\DESKTOP\05001720 2.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

General

Soil samples obtained from the explorations were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate index properties of the soil samples. Representative samples were selected for laboratory testing consisting of the determination of the moisture content, grain size distribution (sieve analyses), and plasticity characteristics (Atterberg limits). The tests were performed in general accordance with test methods of the American Society for Testing and Materials (ASTM) or other applicable procedures.

Moisture Content Testing

Moisture content tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The results of these tests are presented on the exploration logs in Appendix A at the depths at which the samples were obtained.

Percent Passing U.S. No. 200 Sieve (%F)

Selected samples were "washed" through the U.S. No. 200 mesh sieve to estimate the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to estimate the fines content for analysis purposes. The tests were conducted in accordance with ASTM D 1140, and the results are shown on the exploration logs in Appendix A at the respective sample depths.

Grain Size Analyses

Sieve analyses were performed on selected samples in general accordance with ASTM D 422. The wet sieve analysis method was used to determine the percentage of soil passing the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, classified in general accordance with the Unified Soil Classification System, and are presented in Figures B-1 through B-5.

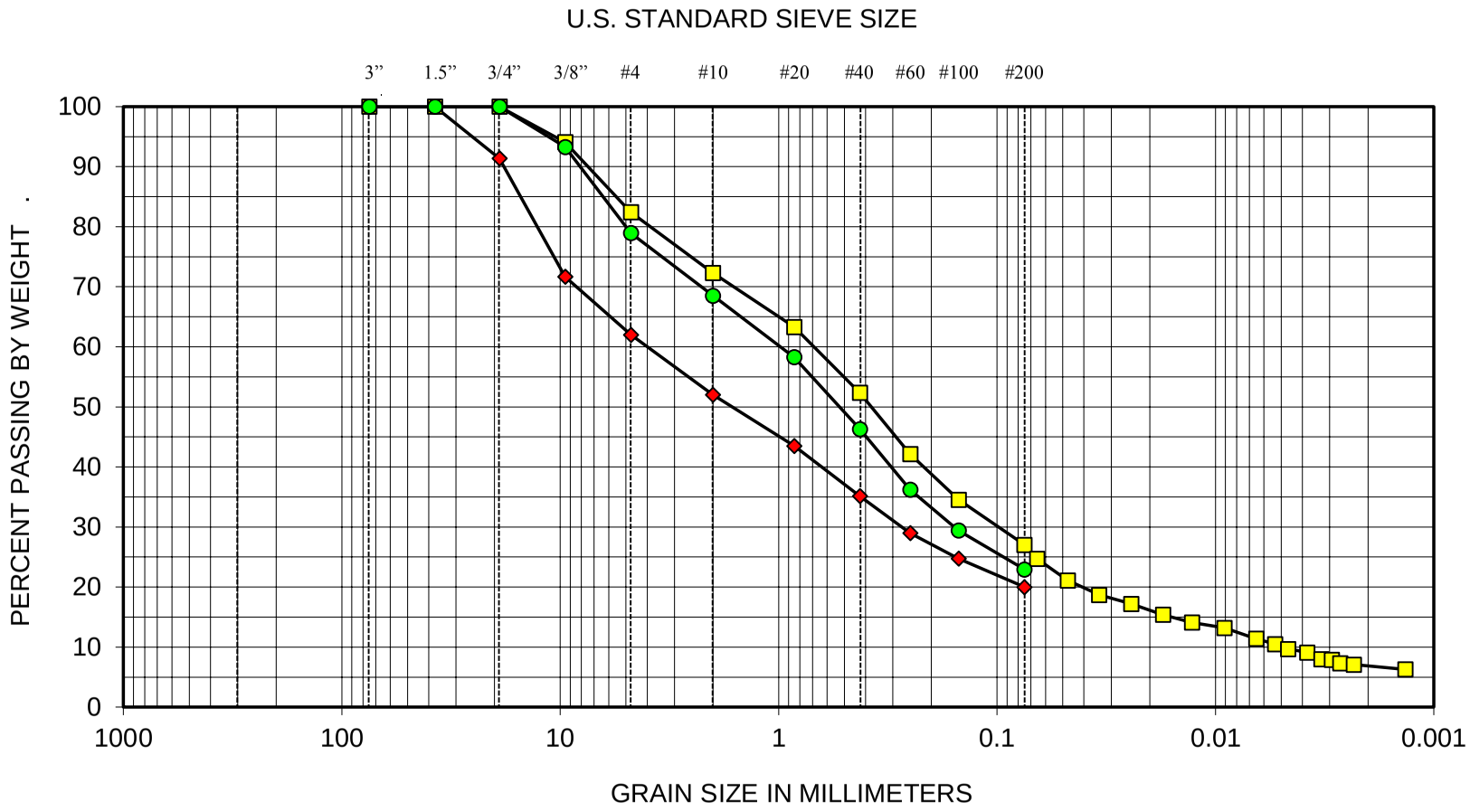
Combined sieve and hydrometer testing were performed on selected samples in general accordance with ASTM D 422-63. The sieve analysis procedure described above was used to evaluate the grain size distribution for soils retained on the U.S. No. 200 mesh sieve, and a hydrometer was used to evaluate the grain size distribution of a representative sample of soil passing the U.S. No. 10 sieve suspended in liquid. The results of the combined sieve and hydrometer testing are presented in Figures B-1 through B-5.

It should be noted that the sieve analyses were performed on soils obtained from samplers that have an opening size of 3 inches so larger sized particles can't be obtained by the samplers. Therefore, the sieve results do not account for soil particles that are larger than 3 inches. Soils with larger sized materials are described in this report qualitatively based on visual observations and experience on projects where excavations were made into similar formations.

Atterberg Limits

Atterberg Limit Tests were performed on selected samples in general accordance with ASTM Test Method D 4318. The test was used to classify the soil as well as to evaluate index properties. The liquid limit and the plastic limit were estimated through a procedure performed in general accordance with ASTM D 4318. The results of the Atterberg limits testing are summarized in Figure B-6.

0500-172-02 SAS: SAS 10-17-2014



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

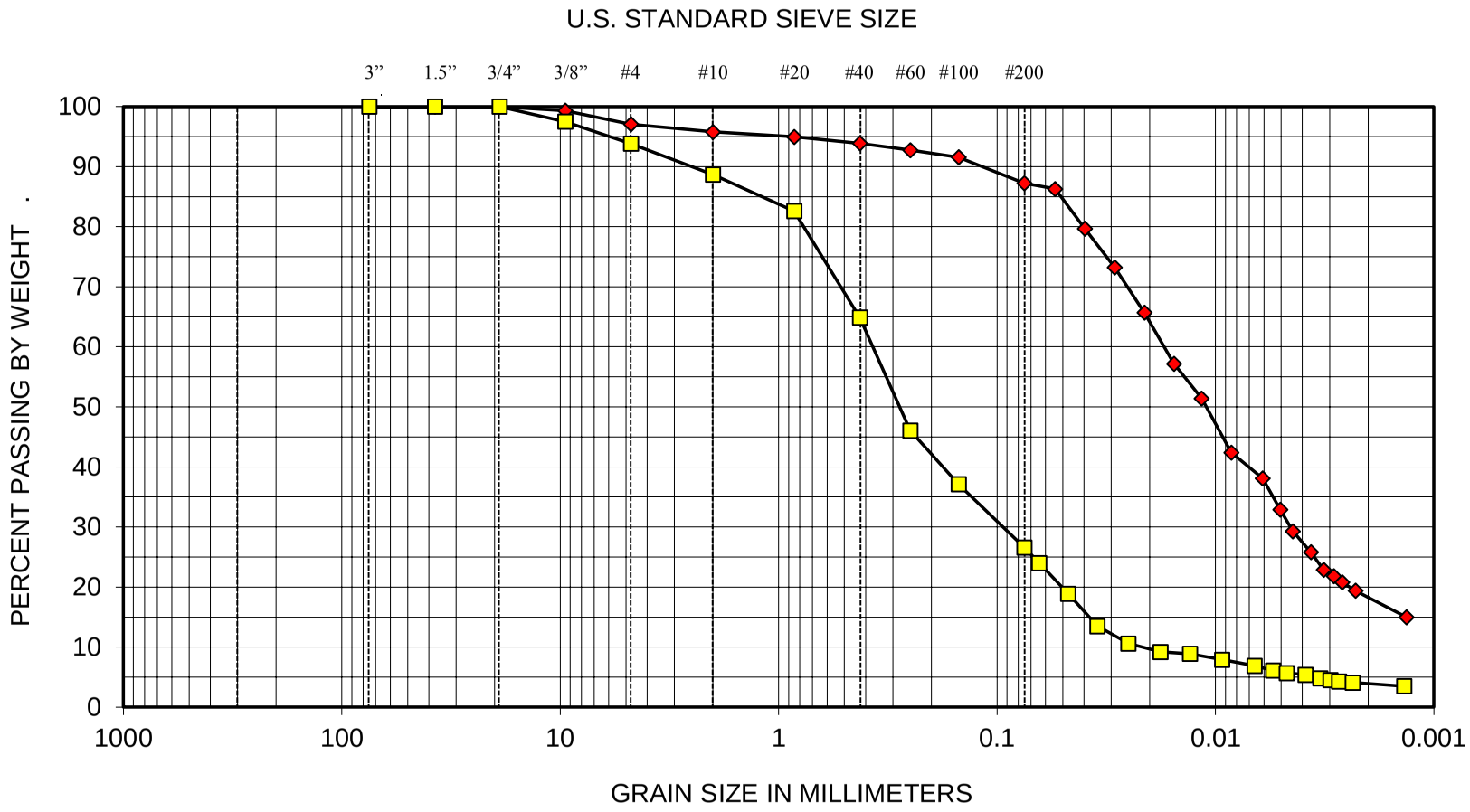
SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	B-2-14	7½	Silty fine to coarse sand with gravel (SM)
□	B-3-14	5	Silty fine to coarse sand with gravel (SM)
●	B-3-14	10	Silty fine to coarse sand with gravel (SM)

GEOENGINEERS

SIEVE-HYDROMETER ANALYSIS RESULTS

FIGURE B-1

GEOENGINEERS



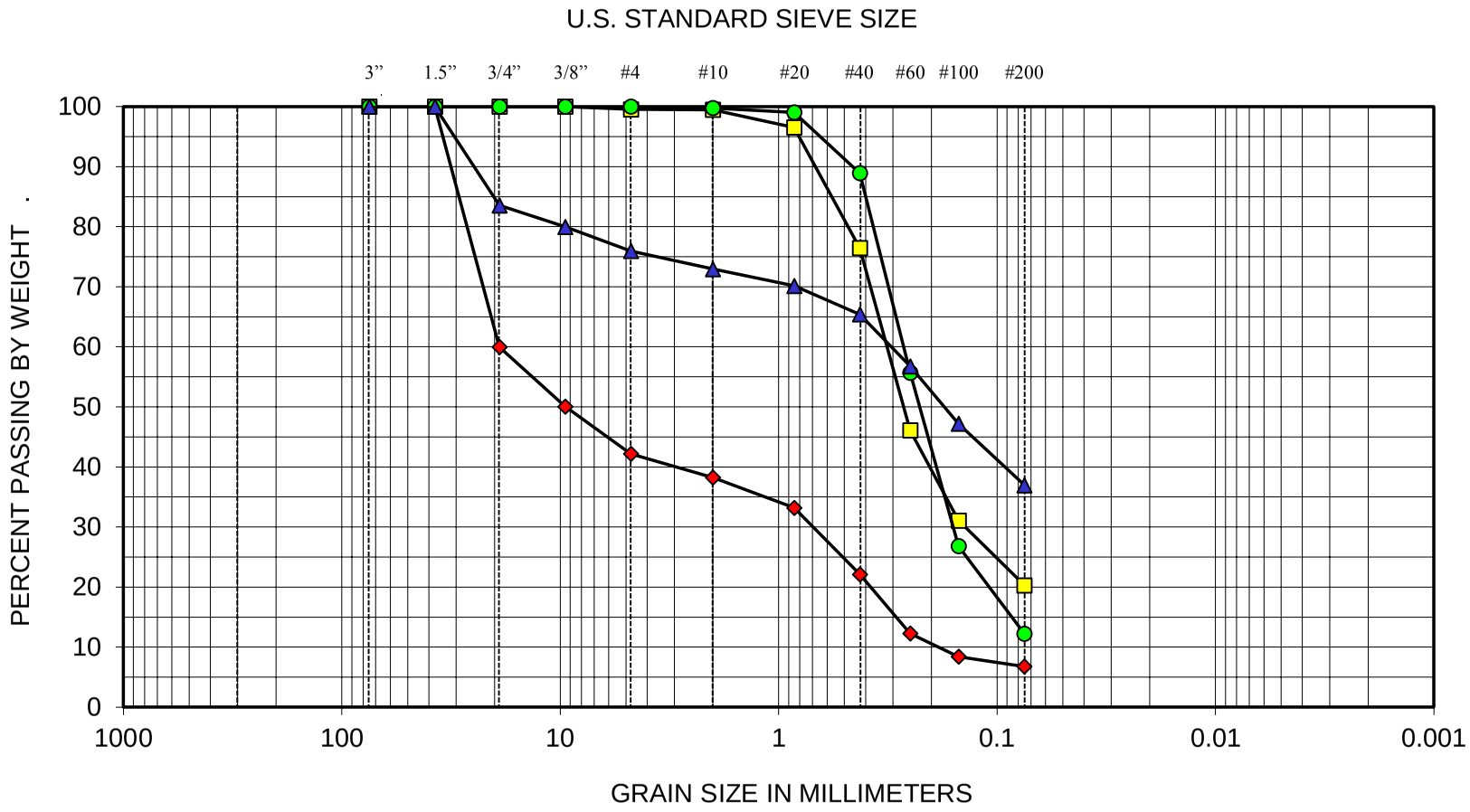
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	B-4-14	2½	Gray lean clay (CL)
□	B-5-14	2½	Silty fine to medium sand (SM)

SIEVE-HYDROMETER ANALYSIS RESULTS

FIGURE B-2

0500-172-02 SAS: SAS 09-20-2013



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

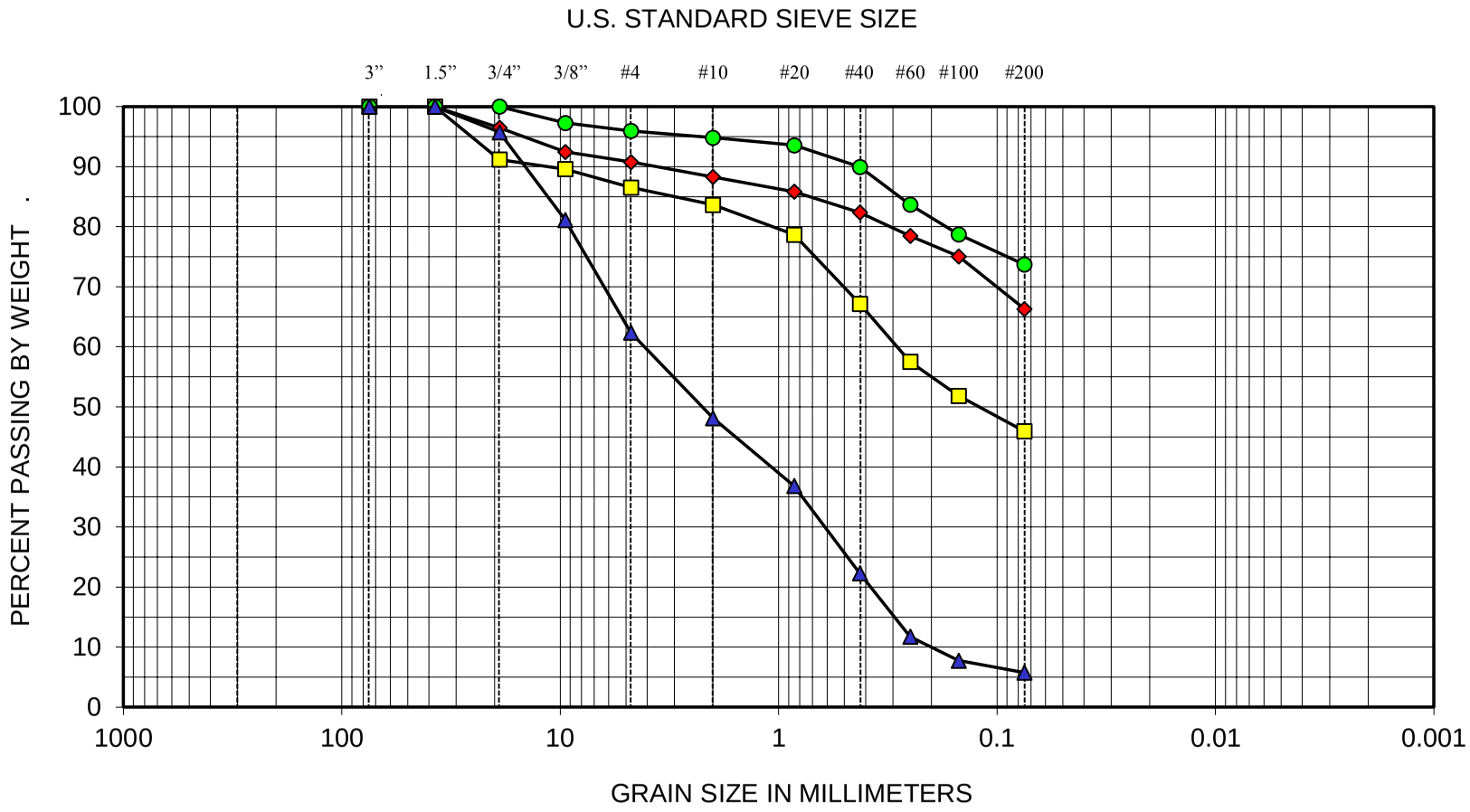
SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	HA-1-13	1	Fine to coarse gravel with silt and sand (GP-GM)
□	HA-2-13	4½	Silty fine to medium sand (SM)
○	HA-4-13	5	Silty fine to medium sand (SM)
▲	HA-7-13	½	Silty fine sand with gravel (SM)

GEOENGINEERS

SIEVE ANALYSIS RESULTS

FIGURE B-3

GEOENGINEERS



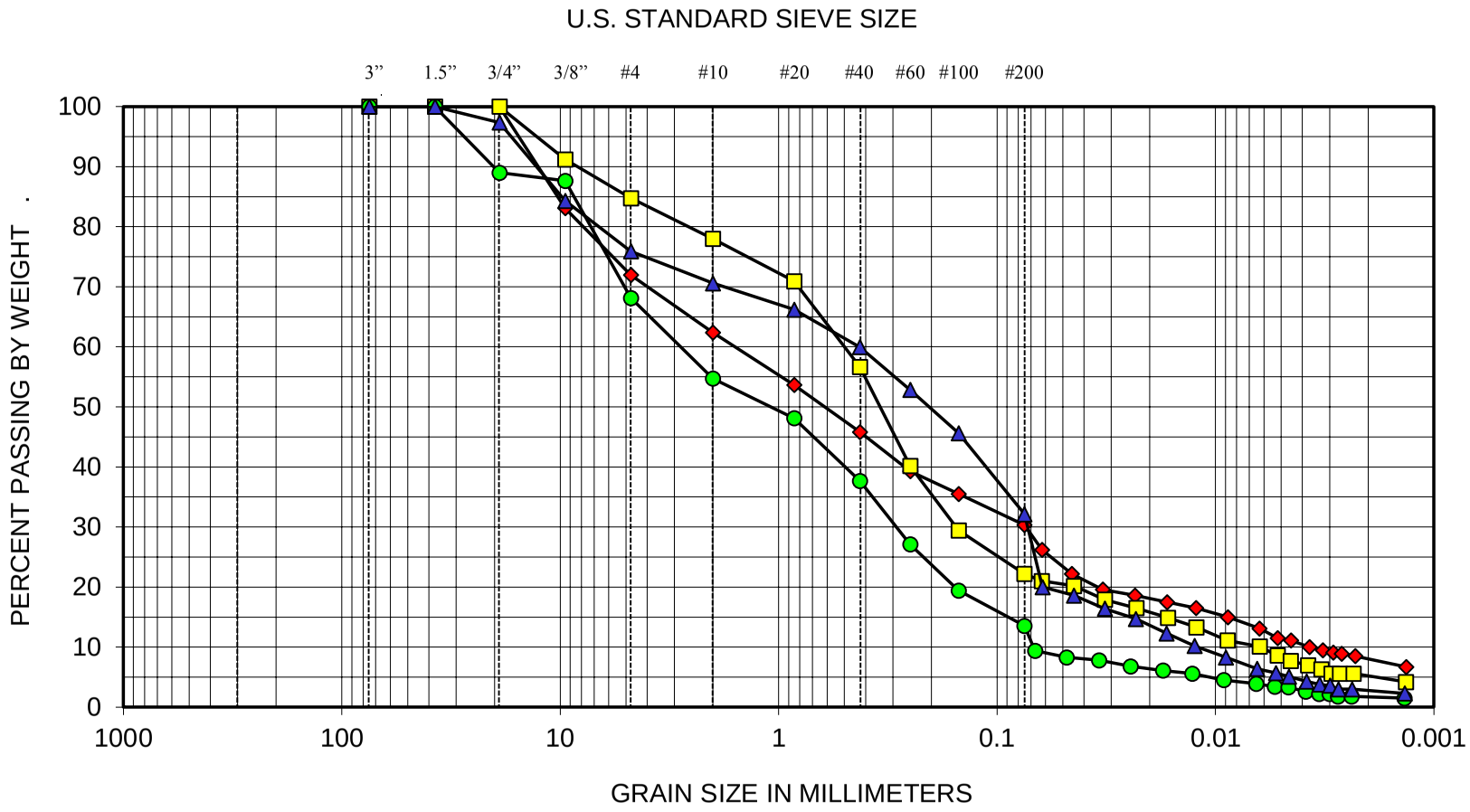
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	HA-8-13	2	Sandy clay with occasional gravel (CL)
□	HA-9-13	2½	Silty fine to medium sand with occasional gravel (SM)
○	HA-10-13	2	Clay with sand (CL)
▲	HA-11-14	1½	Fine to coarse sand with silt and gravel (SP-SM)

SIEVE ANALYSIS RESULTS

FIGURE B-4

GEOENGINEERS



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

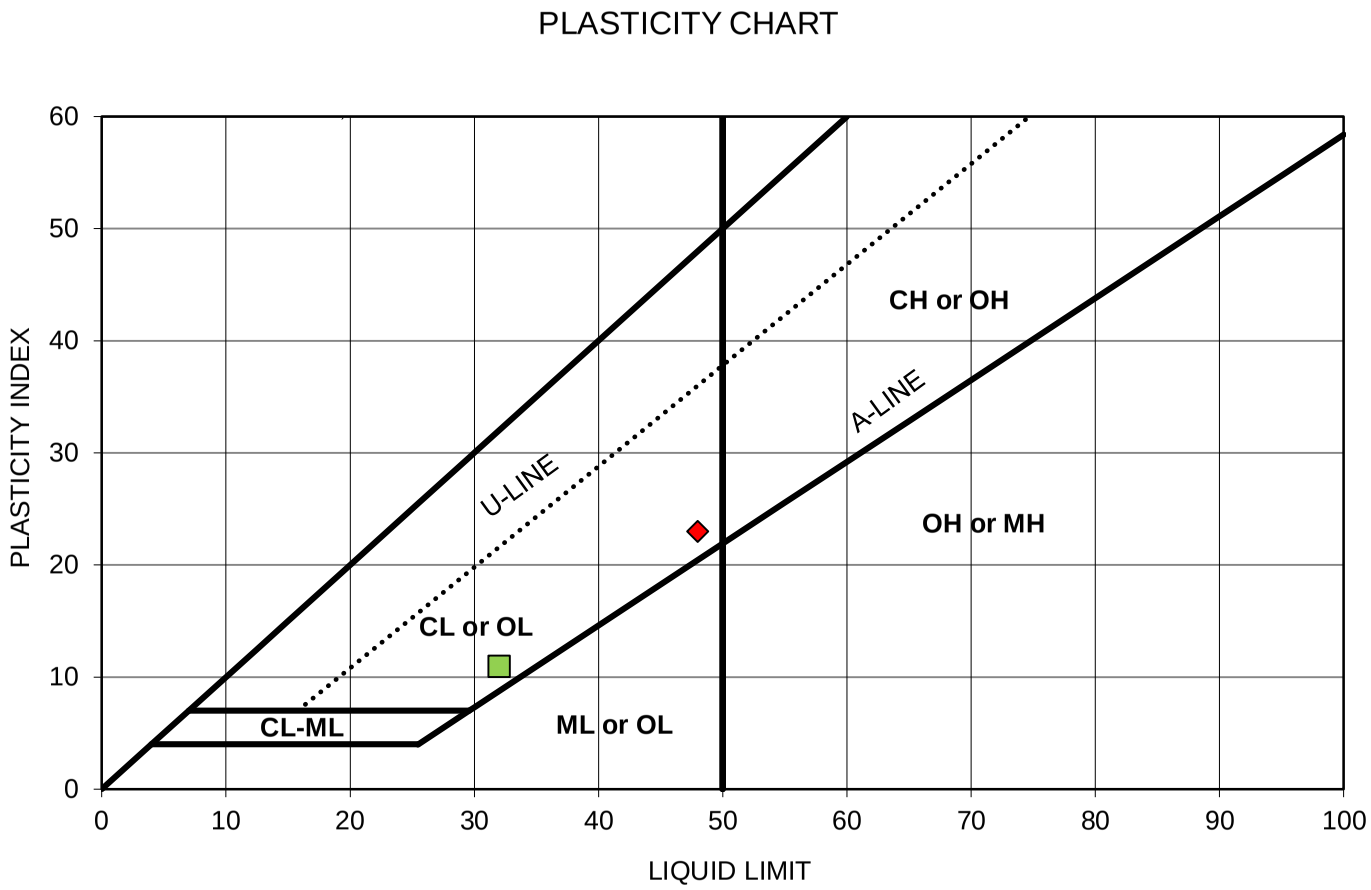
SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	HA-12-14	½	Silty fine to coarse sand with gravel (SM)
□	HA-13-14	1½	Silty fine to coarse sand with gravel (SM)
○	HA-14-14	1½	Silty fine to coarse sand with gravel (SM)
▲	HA-15-14	1½	Silty fine to medium sand with gravel (SM)

SIEVE-HYDROMETER ANALYSIS RESULTS

FIGURE B-5

0500-172-02 SAS: SAS 10-17-14

GEOENGINEERS



SYMBOL	EXPLORATION NUMBER	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SOIL DESCRIPTION
◆	B-4-14	5	17	48	23	Lean clay (CL)
■	HA-6-13	5	22	32	11	Sandy lean clay (CL)

ATTERBERG LIMITS TEST RESULTS

FIGURE B-6

APPENDIX C
Previous Geotechnical Data

Drilled Start 10/25/2011 End 10/25/2011	Total Depth (ft) 31.5	Logged By TT Checked By CMK	Driller Geologic Drill, Inc.	Drilling Method Hollow Stem Auger	
Surface Elevation (ft) 35.5 Vertical Datum NAVD88		Hammer Data Auto 140 (lbs) / 30 (in) Drop		Drilling Equipment Track Mounted Diedrich D-50	
Easting (X) Northing (Y)		System Datum		Groundwater Date Measured 10/25/2011	Depth to Water (ft) 13.0 / Elevation (ft) 22.5
Notes: Auger Data: 3 1/4 inch I.D.					

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
35	0							TS	Topsoil / duff			
		14	18		1			MH	Light gray elastic silt (stiff to very stiff, moist) (diatomaceous earth)			
30	5	18	11		2 / AL					79		
		16	6		3A 3B			OH	Brown organic silt with trace fine sand (soft to medium stiff, moist)			
25	10	18	4		4A / AL / 4B					96		
		14	9		5	▽		SP-SM	Gray fine to medium sand with silt (loose, moist to wet)			
20	15	18	P		6			CL	Gray lean clay with trace sand (very soft, wet)			
		18	12		7			GP	Gray gravel with coarse sand (medium dense, wet)			
15	20	18	22		8			SP	Gray-brown coarse sand with gravel (medium dense to very dense, wet)			8 inches of heave at 20 feet Begin drilling with water head
10	25	0	30		9							No recovery due to sampler not fitted with catcher
5	30	6	63		10							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1

GEOENGINEERS

Project: Redmond Central Connector
Project Location: Redmond, Washington
Project Number: 0500-172-01

Figure A-2
Sheet 1 of 1

Redmond: Date:11/23/11 Path:W:\REDMOND\PROJECTS\0500172\01\GINTREDMOND CENTRAL CONNECTOR BORING LOGS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start 10/25/2011 End 10/25/2011	Total Depth (ft) 26.5	Logged By TT Checked By CMK	Driller Geologic Drill, Inc.	Drilling Method Hollow Stem Auger
Surface Elevation (ft) 35.0 Vertical Datum NAVD88		Hammer Data Auto 140 (lbs) / 30 (in) Drop	Drilling Equipment Track Mounted Diedrich D-50	
Easting (X) Northing (Y)		System Datum	Groundwater Date Measured 10/25/2011	Depth to Water (ft) 15.0 / Elevation (ft) 20.0
Notes: Auger Data: 3 1/4 inch I.D.				

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0							TS	Topsoil / duff			
		18	11		1			MH	Light gray elastic silt (medium stiff to stiff, moist) (diatomaceous earth)			
30	5	18	6		2 SA					54		%F = 94
		18	3		3			OL	Dark gray-brown organic silt and fine sand interbeds (soft to medium stiff, moist)			
25	10	15	5		4							
								CL	Gray sandy lean clay (medium stiff, moist to wet)			
20	15	16	25		5A AL 5B	▽		SP-SM	Gray fine to coarse sand with silt and gravel (medium dense, wet)	31		Gravel at 15 feet
								GM	Gray gravel with organic silt lenses (medium dense, wet)			
15	20	10	14		6							Begin drilling with water head
10	25	4	28		7							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-2

GEOENGINEERS

Project: Redmond Central Connector
Project Location: Redmond, Washington
Project Number: 0500-172-01

Figure A-3
Sheet 1 of 1

Redmond: Date:3/13/12 Path:C:\USERS\TNASH\DESKTOP\REDMOND CENTRAL CONNECTOR BORING LOGS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled	Start 10/25/2011	End 10/25/2011	Total Depth (ft) 26.5	Logged By TT / Checked By CMK	Driller Geologic Drill, Inc.	Drilling Method Hollow Stem Auger
Surface Elevation (ft) / Vertical Datum	34.0 NAVD88		Hammer Data	Auto 140 (lbs) / 30 (in) Drop	Drilling Equipment	Track Mounted Diedrich D-50
Easting (X) / Northing (Y)			System Datum		Groundwater	
Notes: Auger Data: 3 1/4 inch I.D.					Date Measured 10/25/2011	Depth to Water (ft) 14.0 / Elevation (ft) 20.0

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0							TS	Topsoil / duff			
								MH	Gray elastic silt (medium stiff to stiff, moist) (diatomaceous earth)			
30		18	10		1 SA					62		%F = 76
	5	18	7		2							
		10	P		3			PT-OL	Dark brown peat / gray organic silt (very soft, moist)			
25												
	10	18	P		4							
								CL	Gray lean clay with sand (soft to medium stiff, moist to wet)			
		18	18		5A AL 5B	▽		SP-SM	Gray fine to coarse sand with silt and gravel (medium dense, wet)	30		
20												Gravel at 14 feet
	15	12	24		6							Begin drilling with water head
15								GM	Gray silty gravel with sand and trace organic matter (medium dense, wet)			
	20	12	28		7							
10								SP-SM	Gray fine to coarse sand with silt and gravel (medium dense, wet)			
	25	18	26		8							

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-3

GEOENGINEERS

Project: Redmond Central Connector
Project Location: Redmond, Washington
Project Number: 0500-172-01

Figure A-4
Sheet 1 of 1

Redmond: Date:3/13/12 Path:C:\USERS\TNASH\DESKTOP\REDMOND CENTRAL CONNECTOR BORING LOGS.GPJ DBTemplate/LibTemplate/GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled	Start 10/25/2011	End 10/25/2011	Total Depth (ft) 39	Logged By TT / Checked By CMK	Driller Geologic Drill, Inc.	Drilling Method Hollow Stem Auger
Surface Elevation (ft) / Vertical Datum	51.5 NAVD88		Hammer Data	Auto 140 (lbs) / 30 (in) Drop	Drilling Equipment	Track Mounted Diedrich D-50
Easting (X) / Northing (Y)			System Datum		Groundwater	

Date Measured	Depth to Water (ft)	Elevation (ft)
10/25/2011	31.0	20.5

Notes: Auger Data: 3 1/4 inch I.D.

Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
0						GP	Railroad ballast (fill)			
	0	1		1		AIR	Void			
						SM	Brown silty fine to coarse sand with gravel (very loose to loose, moist)			
5	1	4		2						
	0	0		3						
10	7	2		4 SA				13		%F = 27
	6	1		5						
15	6	2		6			(woody debris)			
	8	7		7 AL		CL	Gray lean clay with sand, occasional gravel and trace organic matter (stiff, moist)	29		
20	18	4		8		CL	Gray-blue lean clay (medium stiff, moist)			
						OH	Brown organic silt with organic matter (woody debris) (soft to medium stiff, moist)			
	18	6		9		MH	Gray-brown elastic silt with trace organic matter (medium stiff, moist)			
25	18	5		10 AL				80		
	18	6		11A 11B		OL/PT	Dark brown peat/organic silt (medium stiff, moist)			
30	18	6		12A 12B	▽	SM	Gray silty fine to coarse sand with occasional gravel (loose, wet)			
						ML	Gray sandy silt (medium stiff, wet)			
	18	17		13A 13B		ML	Brown silt with organic matter (medium stiff, wet)			Gravel at 32 feet Begin drilling with water head
						SM	Gray silty fine to coarse sand with gravel (medium dense, wet)			
35	10	38		14		GM	Gray silty gravel with sand (dense, wet)			
	15	31		15		GP-GM	Gray gravel with silt and sand (dense, wet)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-4

GEOENGINEERS

Project: Redmond Central Connector
Project Location: Redmond, Washington
Project Number: 0500-172-01

Figure A-5
Sheet 1 of 1

Redmond: Date:11/23/11 Path:W:\REDMOND\PROJECTS\0\0500172\01\GINT\REDMOND CENTRAL CONNECTOR BORING LOGS.GPJ DBTemplate:LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

TEST DATA

BORING B-1

DESCRIPTION

Surface Elevation (ft.): 44.0

Depth in Feet	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
0						SP	Brown fine to coarse sand with fine gravel and a trace of silt (loose, moist) (fill)
1	CP, CBR						
2							
3				9			
4							
5							
6						SP	Brown fine to medium sand with a trace of silt (loose, wet)
7							
8	MD	23	105	9			
9							
10							
11							
12						ML	Gray sandy silt with roots (medium stiff, wet)
13	MD	23	103	7			
14							Boring completed at 14.0 feet on 04/02/96 Ground water encountered at approximately 8.0 feet
15							
16							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

:TAT:CMS 4/25/96

0500-089-20-1130

GeoEngineers

LOG OF BORING

FIGURE A-3

TEST DATA

BORING B-2

DESCRIPTION

Surface Elevation (ft.): 44.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
					ASPHALT	4 inches asphalt concrete
						2 inches crushed gravel
					SP	Brown fine to medium sand with silt and fine gravel (medium dense, moist) (fill)
					SP	Brown fine to medium sand with silt (loose, moist) (fill)
MD	26	92	5			
			10		ML	Brown sandy silt (medium stiff to stiff, wet)
			12		SP	Gray silty sand (medium dense, wet)

DEPTH IN FEET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Boring completed at 14.0 feet on 04/02/96
Ground water encountered at approximately 4.0 feet

Note: See Figure A-2 for explanation of symbols

:TAT:CMS 4/25/96

0500-089-20-1130

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LOG OF BORING

FIGURE A-4

TEST DATA

BORING B-3

DESCRIPTION

Surface Elevation (ft.): 41.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
					TOPSOIL	Sod and topsoil
					ML	Gray sandy silt with roots and wood (soft to medium stiff, moist) (fill?)
			5			
					SP	Brown fine sand with silt lenses (very loose to loose, wet)
			2			
					OL	Gray organic silt (very soft, wet)
MD	63	61	1			

DEPTH IN FEET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Boring completed at 14.0 feet on 04/02/96
Ground water encountered at approximately 8.0 feet

Note: See Figure A-2 for explanation of symbols

:TAT:CMS 4/25/96

0500-089-20-1130

GeoEngineers

LOG OF BORING

FIGURE A-5

TEST DATA

BORING B-4

DESCRIPTION

Surface Elevation (ft.): 43.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
					ASPHALT	4 inches asphalt concrete
						2 inches crushed gravel
					SP	Brown fine to medium sand and a trace of silt (medium dense, moist) (fill)
					ML	Gray sandy silt (soft to medium stiff, moist)
			5			
					SP	Black medium sand a trace of silt (loose, wet)
			5			
					OL	Gray organic silt (very soft, wet)
MD, CS	108	42	1			

DEPTH IN FEET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Note: See Figure A-2 for explanation of symbols

:TAT:CMS 4/26/96

0500-089-20-1130

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LOG OF BORING

FIGURE A-6

TEST DATA

BORING B-4 (Continued)

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	DESCRIPTION
					OL	Brown organic silt with roots (soft, wet)
MD	131	35	4			
					SP	Gray medium to coarse sand with gravel (medium dense, wet)
			20			
						Boring completed at 24.0 feet on 04/02/96 Ground water encountered at 2.5 feet

DEPTH IN FEET: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

Note: See Figure A-2 for explanation of symbols

:TAT:CMS 4/25/96

0500-089-20-1130

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LOG OF BORING

FIGURE A-6

BORING NO. 9

(Approximate Station: 28+45, 1 foot west)

Approximate Elevation: 30.5 feet

Depth in Feet	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow-Count	Samples	Group Symbol	Description
0						OL/ML	LIGHT BROWN ORGANIC SILT AND DIATOMACEOUS EARTH (SOFT, MOIST)
5	MD, CS	88.7	45.1	4	■		
8	MD, DS	16.9	104.4	36	■	SP-SM	GRAY FINE SAND WITH SILT (MEDIUM DENSE TO DENSE, WET)
10						SP	GRAYISH BROWN FINE TO MEDIUM SAND WITH COARSE SAND AND GRAVEL (MEDIUM DENSE, WET)
13	MD	34.3	89.1	22	■		
18				28	■		
23	MD, DS	16.9	104.4	16	■		
26						SW	GRAY FINE TO COARSE SAND WITH GRAVEL (MEDIUM DENSE, WET)
28				18	■		
33	MD	13.4	128.3	22	■		
38				20	⊠		
40							

DEPTH IN FEET

BORING COMPLETED AT 39.5 FEET ON 11/05/87
PIEZOMETER INSTALLED TO 38 FEET
GROUND WATER LEVEL MEASURED AT 11.5 FEET ON 11/12/87

Note: See Figure A-2 for Explanation of Symbols

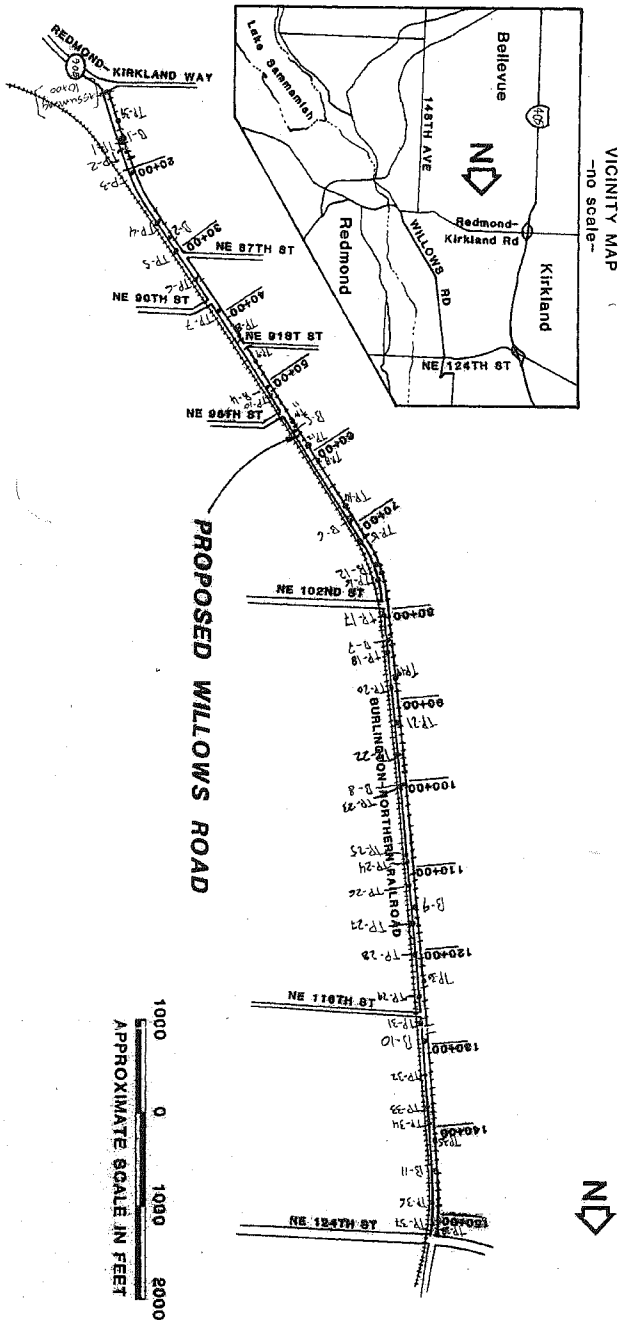
GeoEngineers Incorporated

LOG OF BORING

FIGURE A-18

0500-11-5 11/06/87 dmp:hr

Form No. 050/76



REFERENCE: "VICINITY MAP AND INDEX-City of Redmond", project number 79199, undated by Jones Associates, Inc.

ConverseWardDavisDixon Geotechnical Consultants

SITE PLAN AND VICINITY MAP

WILLOWS ROAD LID
Redmond, Washington
for City of Redmond

Scale NOTED
Date SEP 1980
Prepared by JM
Checked by RLP
Approved by RLP
Project No. 79-5209
Drawing No. 1

Form No. 050/77 Approved for publication _____ by _____

SUMMARY
BORING NO. 1

Located on existing roadway, Sta. 16+90

DATE DRILLED: 11/15/79

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

ELEVATION:

DEPTH IN FEET	SAMPLES	SYMBOL			BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.
0			5½" Asphalt					
	1		SILTY SAND (Fill)	brown, fine to coarse, little fine gravel, trace organics; slightly moist, medium dense.	8 8 8	14.5		
	2				7 8 8			
5	3		SANDY SILT (Fill or Weathered Till)	brown, trace organics; moist, medium dense.	12 22 42			
	4		CLAYEY SILT (Till)	gray-brown, some fine to coarse sand; very stiff.	38 62 86	26.2		
10	5		SILT	gray, trace fine sand; hard, slightly cemented.	48 100/3"			
15			Bottom of boring at depth 12.2'. No groundwater encountered at time of drilling.					
20								
25								
30								

WILLOWS ROAD LID
Redmond, Washington
for City of Redmond

Project No. 79-5209

ConverseWardDavisDixon Geotechnical Consultants

Drawing No. 2

Converse Ward Davis Dixon, 1980

SUMMARY BORING NO. 2

Located on existing roadway, Sta. 28 + 60

DATE DRILLED: 11/15/79

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

ELEVATION:

DEPTH IN FEET	SAMPLES	SYMBOL		BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.
0			Asphalt (6"), Sand and Gravel Fill (5").				
	1		SILTY SAND (Till) — brown and gray mottled, fine with little fine to coarse weathered gravel; slightly moist to moist, very dense.	10 25 74			
	2			77 100/3"			
5	3						
10			Bottom of boring at depth 7'. (At 7' encountered boulders, broke drill bit, terminated boring.) No groundwater encountered at time of drilling.				
15							
20							
25							
30							

WILLOWS ROAD LID
Redmond, Washington
for City of Redmond

Project No. 79-5209

Drawing No. 3

ConverseWardDavisDixon Geotechnical Consultants

FORM NO. D5/77 Approved for publication ____ by ____

SUMMARY BORING NO. 3

Located on existing roadway

DATE DRILLED: 11/16/79

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

ELEVATION:

DEPTH IN FEET	SAMPLES	SYMBOL		BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.
0			Asphalt (3"), Sand and gravel Fill (7")				
	1		SILTY SAND (Fill) — brown, fine to fine to medium SAND, trace organics; moist, medium dense.	2,13, 34			
	2			13,21,18	18.2	10.9	
	3			8,15,24	15.8	110	
5	4			5,7, 8			
			SILTY CLAY (Lacustrine) — gray, occasional thin sand and silt interbeds; soft.	3 7 11	16.4	107	
	5						
10			FIBROUS PEAT (Lacustrine) — brown, soft, appears compressed; with interbeds of silt.	4 4 8	338.7	29	
	6			6 13 15			
	7		Interbedded SANDY SILT and CLAYEY SILT (Lacustrine) — gray, thin interbeds of fine sand; soft to medium stiff.	6 9 12			
15	8			4 11 64			
	9		SAND — gray, fine to coarse with fine to coarse gravel, trace cobbles; moist, medium dense.	20 37 48			
20							
	10						
25			Bottom of boring at depth 24½'. Groundwater encountered at approx. 12'.				
30							

WILLOWS ROAD LID
Redmond, Washington
for City of Redmond

Project No. 79-5209

Drawing No. 4

ConverseWardDavisDixon Geotechnical Consultants

FORM NO. D5/77 Approved for publication ____ by ____

Converse Ward Davis Dixon, 1980

APPENDIX D
Report Limitations and Guidelines for Use

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the City of Redmond, Otak and other project team members for the Redmond Central Connector (RCC) Phase II project. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report Is Based on a Unique Set of Project-specific Factors

This report has been prepared for the RCC Phase II project in Redmond, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

---

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

Have we delivered World Class Client Service?

Please let us know by visiting **www.geoengineers.com/feedback**.

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Appendix G — Stormwater Pollution Prevention Plan (SWPPP)

City of Redmond
Redmond Central Connector
Phase II

Stormwater Pollution Prevention Plan

Prepared by:
Otak, Inc.
11241 Willows Road NE, Suite 200
Redmond, WA 98052
Otak Project Number 32246

September 30, 2015

HanmiGlobal Partner

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Redmond Central Connector Phase II

Prepared for:

The Washington State Department of Ecology

Northwest Regional Office

Permittee / Owner	Developer	Operator / Contractor
City of Redmond 15670 NE 85th Street Redmond, WA 98073	City of Redmond 15670 NE 85th Street Redmond, WA 98073	TBD

Redmond, Wa.

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Touta Phengsavath	Otak, Inc.	(425) 822-4446

SWPPP Preparation Date

10/02/15

Project Construction Dates

Activity / Phase	Start Date	End Date
Phase II	Spring 2016	Fall 2016

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G. Contaminated Site Information

H. Engineering Calculations

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: Redmond Central Connector Phase II
Street/Location: BNSF Corridor, adjacent to Willows Rd NE
((from Sammamish River to 9900 Block),
City: Redmond State: Wa Zip code: 98052
Subdivision: N/A
Receiving waterbody: Sammamish River

1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 15.5 Ac
Disturbed acreage: 12 Ac
Existing structures: Sammamish River Trestle and 154th Ave NE Bridge
Landscape topography: Relatively flat and gentle uphill slope west of the project site
Drainage patterns: Drainage generally flows from west to east across project site
Existing Vegetation: Herbaceous layers of various grass species and reed canary grass and shrub layers dominated by Himalayan blackberry, Scotch broom, and red-osier dogwood
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): 21 Wetlands, 4 Streams

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: None

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
None			

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
Construction of paved non-motorized regional trail along the former BNSF rail corridor.

Description of construction activities (example: site preparation, demolition, excavation):

- Construction of approximately 1.3 miles regional trail along the former Burlington Northern Railroad corridor from east of the Sammamish River to the south side of the intersection of Willows Road and the 9900 Block.
- The trail will generally consist of a 12-foot wide paved (approximately 0.5 miles of porous pavement and 0.8 miles of hot mixed asphalt pavement) trail with 2-foot gravel shoulder along the west side and 3-foot gravel shoulder along the east side.
- Bridge retrofit of the Sammamish River trestle and 154th Avenue NE crossing.
- Construction of retaining walls in vicinity of Sammamish River and 154th Avenue NE crossings.
- Grading and installation of storm drainage facilities.
- Replace existing culvert at Willows Creek with fish passable culvert.
- Install raised trail crossing and associated improvements at driveway crossings (8700 block and Arena Sports).
- Intersection improvements at NE 90th Street and NE 95th Street (curb ramps, curb and gutter, pavement restoration, hardscape/landscape features, and pavement marking).
- Pedestrian traffic signal modifications at NE 90th Street and NE 95th Street.
- New illumination system along entire length of trail.
- Installation of landscape and urban design improvements.
- Wetland and stream mitigation.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

The proposed project lies within six distinct Threshold Discharge Areas, TDA 1 through 6, summarized in Table 1 below. TDA 1 contains Basins A and A1 and drains to the Sammamish River. TDA 1 is bound by the RCC Phase I Trail to the east (STA 6+68) and STA 17+80 to the west, and includes a portion of the existing railroad that crosses over the Sammamish River and 154th Avenue NE. Basins B and B1 are in TDA 2, where flows exceeding infiltration capacity would drain to an existing stormwater network outfalling near NE 85th Street. TDA 2 begins at STA 17+80.00 and ends at the southern edge of NE 90th Street. Basin C is in TDA 3, which drains to Peters Creek. TDA 3 is bound by NE 90th Street to the south and STA 51+67 to the north, and includes the portion of the existing railroad alignment that crosses Peters Creek. Basin D is within TDA 4 and drains to an existing stormwater network on NE 95th Street. TDA 4 is bound by STA 52+03 to the south and NE 95th Street to the north. Basin E is within TDA 5, which drains to Willows Creek. TDA 5 is bound by NE 95th Street to the south and the Willows Creek crossing to the north. Basin F is in TDA 6 and drains to Gun Club Creek. TDA 6 is bound by the Willows Creek crossing to the south and 9900 Block to the north.

Description of final stabilization (example: extent of revegetation, paving, landscaping):

Final site will consist of cement concrete and asphalted concrete surface, revegetation, and landscaping.

Contaminated Site Information:

Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

If encounter, contaminated soil or groundwater will be treated on-site.

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e., hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

2.1 The 12 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

The TESC and Demolition Plans delineate the clearing limits and show the construction fence locations around the project perimeter. The fence will be clearly marked prior to land-disturbing activities. Trees that are to be preserved, as well as all sensitive areas and their buffers, are clearly delineated on the Plans and will be marked in the field prior to construction activities. In general, natural vegetation and native topsoil will be retained in an undisturbed state to the maximum extent possible.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C101: Preserving Natural Vegetation

BMP C102: Buffer Zones

BMP C103: High Visibility Plastic or Metal Fence

BMP C233: Silt Fence

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be installed prior to construction activities

Inspection and Maintenance plan: To be prepared and implemented by Contractor

Responsible Staff: Contractor (TBD)

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas will be minimized, yet where necessary, access points will be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning will be employed to prevent sediment from entering state waters. All wash wastewater will be controlled on site.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C105: Stabilized Construction Entrance/Exit

BMP C106: Wheel Wash

BMP C107: Construction Road/Parking Area Stabilization

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be installed prior construction activities

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor (TBD)

2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled.

Will you construct stormwater retention and/or detention facilities?
☒ Yes ☐ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?
☒ Yes ☐ No

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C203: Water Bars

BMP C207: Check Dams

BMP C209: Outlet Protection

BMP C235: Wattles

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor (TBD)

2.1.4 Element 4: Install Sediment Controls

All stormwater runoff from disturbed areas will be routed through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility.

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or by mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize washoff of sediments from adjacent streets in runoff.

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas (BMP C240 paragraph 5, page 4-102).

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment will be removed after construction is complete and the permanent stormwater BMP will be re-stabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C231: Brush Barrier

BMP C232: Gravel Filter Berm

BMP C233: Silt Fence

BMP C234: Vegetated Strip

BMP C235: Wattles

BMP C250: Construction Stormwater Chemical Treatment

BMP C251: Construction Stormwater Filtration

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor (TBD)

2.1.5 Element 5: Stabilize Soils

Exposed and unworked soils will be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project.

The project site is located west of the Cascade Mountain Crest. As such, no soils will remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils will be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils willl be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Spring 2016 – Fall 2016

Will you construct during the wet season?
☒ Yes ☐ No

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C120: Temporary and Permanent Seeding

BMP C121: Mulching

BMP C122: Nets and Blankets

BMP C123: Plastic Covering

BMP C124: Sodding

BMP C125: Topsoiling/Composting

BMP C126: Polyacrylamide for Soil Erosion Protection

BMP C130: Surface Roughening

BMP C131: Gradient Terraces

BMP C140: Dust Control

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined implemented by Contractor

Responsible Staff: Contractor

2.1.6 Element 6: Protect Slopes

All proposed permanent slopes will be a maximum of 3H:1V and will be stabilized with seeding, vegetation, or landscaping.

Will steep slopes be present at the site during construction?
☒ Yes ☐ No
Maximum existing slopes of approximately 1.5H:1V

All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C120: Temporary and Permanent Seeding

BMP C121: Mulching

BMP C122: Nets and Blankets

BMP C123: Plastic Covering

BMP C124: Sodding

BMP C130: Surface Roughening

BMP C131: Gradient Terraces

BMP C200: Interceptor Dike and Swale

BMP C201: Grass-Lined Channels

BMP C203: Water Bars

BMP C204: Pipe Slope Drains

BMP C205: Subsurface Drains

BMP C206: Level Spreader

BMP C207: Check Dams

BMP C208: Triangular Silt Dike (Geotextile-Encased Check Dam)

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction will be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C220: Storm Drain Inlet Protection

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

2.1.8 Element 8: Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion.

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C202: Channel Lining

BMP C122: Nets and Blankets

BMP C207: Check Dams

BMP C209: Outlet Protection

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (List pollutants and source, if applicable)

All pollutants, including waste materials and demolition debris, that occur onsite willl be handled and legally disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.

- On-site fueling tanks and petroleum product storage containers shall include secondary containment.

- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.

- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.

- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

- Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application procedures and rates shall be followed.

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).

- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).

- Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing Sawcutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C151: Concrete Handling

BMP C152: Sawcutting and Surfacing Pollution Prevention

BMP C153: Material Delivery, Storage and Containment

BMP C154: Concrete Washout Area

BMP C250: Construction Stormwater Chemical Treatment

BMP C251: Construction Stormwater Filtration

BMP C252: High pH Neutralization Using CO2

BMP C253: pH Control for High pH Water

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?
☐ Yes ☒ No

Will wheel wash or tire bath system BMPs be used during construction?
☒ Yes ☐ No

Will be treated before discharging to local storm system.

List and describe BMPs: To be proposed by Contractor and approved by City

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

Will pH-modifying sources be present on-site?
☒ Yes ☐ No

Table 3 – pH-Modifying Sources

☐	None
☐	Bulk cement
☐	Cement kiln dust
☐	Fly ash
☐	Other cementitious materials
☒	New concrete washing or curing waters
☒	Waste streams generated from concrete grinding and sawing
☐	Exposed aggregate processes
☐	Dewatering concrete vaults
☒	Concrete pumping and mixer washout waters
☐	Recycled concrete
☐	Other (i.e., calcium lignosulfate) [please describe:]

List and describe BMPs: To be proposed by Contractor and approved by City

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

2.1.10 Element 10: Control Dewatering

Dewatering will occur at Willows Creek, where the culvert is to be replaced, as shown in the Plans. Water is not anticipated to be contaminated. Dewatering water will be discharged through a sedimentation filtration system.

All dewatering water from open cut excavation, tunneling, foundation work, trench, or underground vaults will be discharged into a controlled conveyance system prior to discharge to a sediment trap. Channels will be stabilized, per Element #8. Clean, non-turbid dewatering water will not be routed through stormwater sediment ponds, and will be discharged to systems tributary to the receiving waters of the State in a manner that does not cause erosion, flooding, or a violation of State water quality standards in the receiving water. Highly turbid dewatering water from soils known or suspected to be contaminated, or from use of construction equipment, will require additional monitoring and treatment as required for the specific pollutants based on the receiving waters into which the discharge is occurring. Such monitoring is the responsibility of the contractor.

However, the dewatering of soils known to be free of contamination will trigger BMPs to trap sediment and reduce turbidity. At a minimum, geotextile fabric socks/bags/cells will be used to filter this material. Other BMPs to be used for sediment trapping and turbidity reduction include the following:

- Concrete Handling (BMP C151)
- Infiltration
- Use of a sedimentation bag, with outfall to a ditch or swale for small volumes of localized dewatering.

Table 4 – Dewatering BMPs

☐	Infiltration
☐	Transport off-site in a vehicle (vacuum truck for legal disposal)
☐	Ecology-approved on-site chemical treatment or other suitable treatment technologies
☒	Sanitary or combined sewer discharge with local sewer district approval (last resort)
☒	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs: To be proposed by Contractor and approved by City; possible BMPs include:

BMP C203: Water Bars

BMP C236: Vegetative Filtration

See *Stormwater Management Manual for Western Washington- Volume II- Construction Stormwater Pollution Prevention* for detailed description of BMP purpose, conditions of use, design and installation specifications, and maintenance standards.

Installation Schedules: To be proposed by Contractor and approved by City

Inspection and Maintenance plan: To be determined and implemented by Contractor

Responsible Staff: Contractor

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs willl be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair will be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs will be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment will be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation will be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction will be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility will be returned to conditions specified in the construction documents.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
  - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
  - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
  - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☐	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
☒	Schedule major earthwork during the dry season
☐	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
[Insert construction activity]	[Insert BMP]	[MM/DD/YYYY]	[Insert Season]
To be implemented by Contractor			

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	[Insert Number]
Resident Engineer	TBD	
Emergency Ecology Contact	TBD	
Emergency Permittee/ Owner Contact	TBD	
Non-Emergency Owner Contact	TBD	
Monitoring Personnel	TBD	
Ecology Regional Office	Northwest Regional Office	425-649-7000

4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

File a blank form under Appendix D.

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

☒	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
☐	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone the applicable Ecology Region's Environmental Report Tracking System (ERTS) number within 24 hours.
    - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for “Significant concrete work” (i.e., greater than 1000 cubic yards poured or recycled concrete over the life of the project). The use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils, pH sampling begins when engineered soils are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

Table 9 – pH Sampling Method

☐	pH meter
☒	pH test kit
☐	Wide range pH indicator paper

5 Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies

5.1 303(d) Listed Waterbodies

Circle the applicable answer, if necessary:

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

☐ Yes ☒ No

List the impairment(s):

N/A

If yes, discharges must comply with applicable effluent limitations in S8.C and S8.D of the CSWGP.

5.2 TMDL Waterbodies

Waste Load Allocation for CWSGP discharges:

N/A

Describe the method(s) for TMDL compliance:

List and describe BMPs:

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

6.1.2 Records Retention

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

6.2 Reporting

6.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.

DMRs will be reported online through Ecology's WQWebDMR System.

To sign up for WQWebDMR go to:
http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html

6.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be immediately notified of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Specific information to be included in the noncompliance report is found in Special Condition S5.F.3 of the CSWGP.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- **Northwest Region** at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call

6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

A. Site Map

B. BMP Detail – To be provided by Contractor

Insert BMPs specification sheets here.
Download BMPs from the Ecology Construction Stormwater website at:
http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html
Select Resources and Guidance to find the links to the Stormwater Manuals.

C. Correspondence

Ecology
EPA
Local Government

D. Site Inspection Form

Create your own or download Ecology's template:
http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html
Select Permit, Forms and Application to find the link to the Construction Stormwater Site Inspection Form.

E. Construction Stormwater General Permit (CSWGP)

Download the CSWGP:
http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html

F. 303(d) List Waterbodies / TMDL Waterbodies Information

Proposed New Discharge to an Impaired Water Body form
SWPPP Addendum addressing impairment

G. Contaminated Site Information

Administrative Order
Sanitary Discharge Permit
Soil Management Plan
Soil and Groundwater Reports
Maps and Figures Depicting Contamination

H. Engineering Calculations

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XREF LIST
Ltscale: 1000
Resolved
KCRD
RED ROAD
GIS BNDY

CITY OF REDMOND

Redmond Central Connector Phase II

City of Redmond
WASHINGTON

otak
HanmiGlobal Partner

11241 Willows Road NE
Suite 200
Redmond, Washington 98052
Phone: (425) 822-4446
FAX: (425) 827-9577
www.otak.com

Federal Aid No. CM-1065(011)
City Project No. 20021314
October 2015

APPROVED FOR CONSTRUCTION

DAVID M. PAUL, P.E.
CITY ENGINEER
CITY OF REDMOND

DATE

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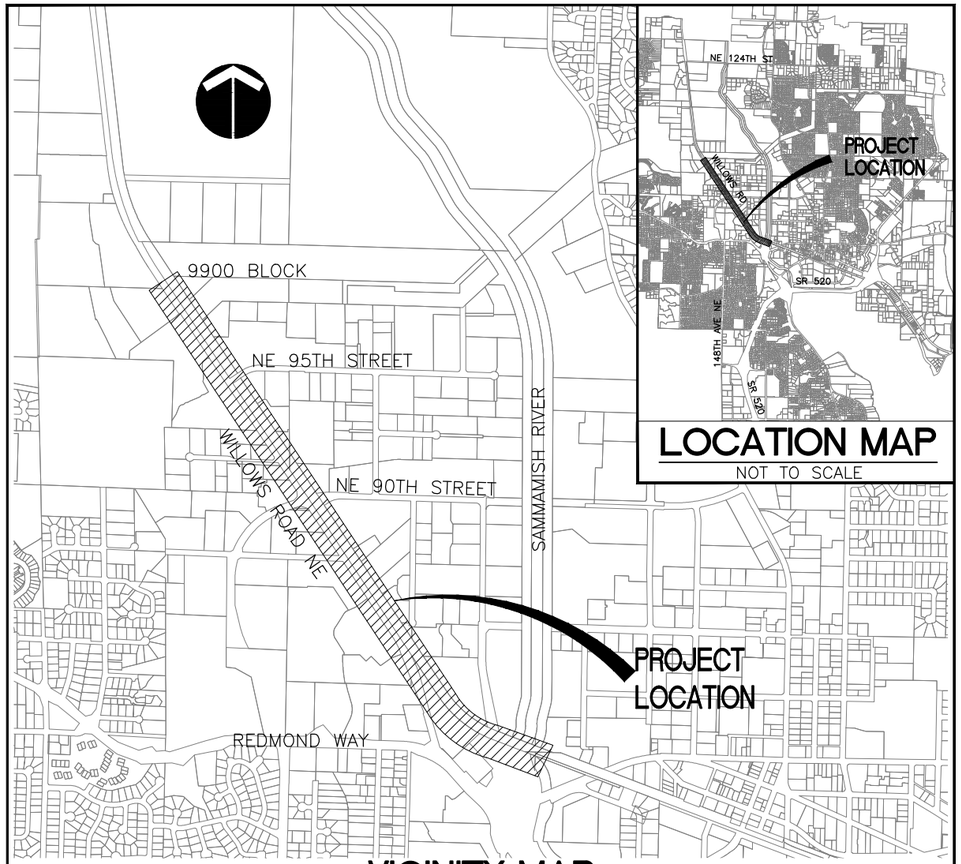

LOCATION MAP
NOT TO SCALE

VICINITY MAP
NOT TO SCALE

INDEX OF DRAWINGS

DRAWING NO.	SHEET NO.	DESCRIPTION
		GENERAL
1.01	1	COVER SHEET, VICINITY MAP AND SHEET INDEX
1.02	2	LEGEND, ABBREVIATIONS, AND GENERAL NOTES
1.03–1.04	3–4	CONSTRUCTION ALIGNMENT AND SURVEY CONTROL PLAN
		TESC AND DEMOLITION
2.01–2.08	5–12	TESC AND DEMOLITION PLAN
		TEMPORARY STREAM BYPASS
2.09	13	TEMPORARY STREAM BYPASS
		TRAIL AND DRAINAGE
3.01–3.16	14–29	TRAIL AND DRAINAGE PLAN AND PROFILE
3.17–3.24	30–37	TRAIL AND DRAINAGE DETAILS
		METAL STAIR
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4.01	40	BRIDGE LAYOUT – SAMMAMISH RIVER TRESTLE
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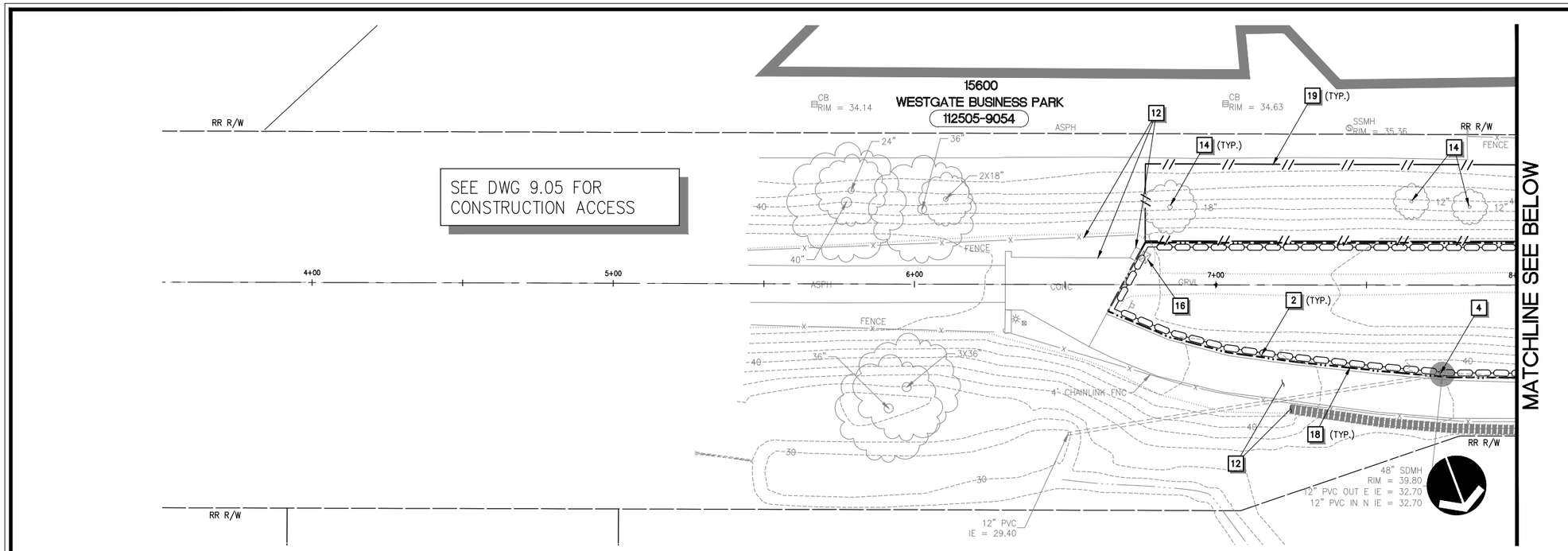

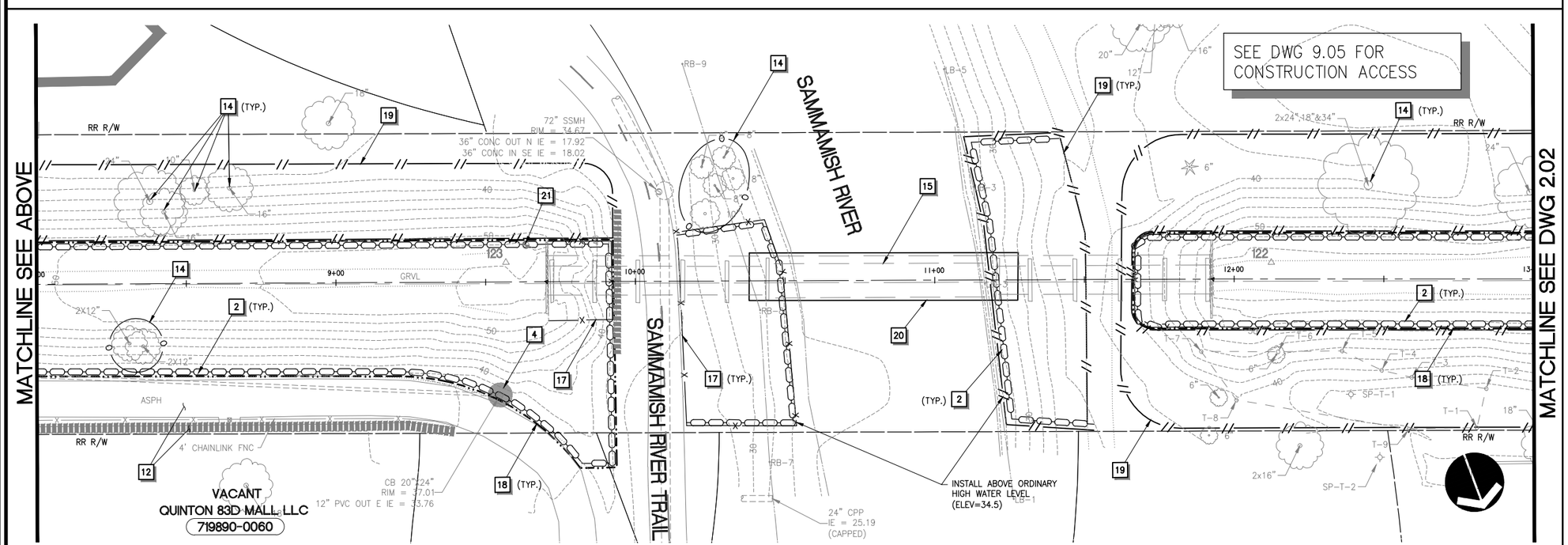

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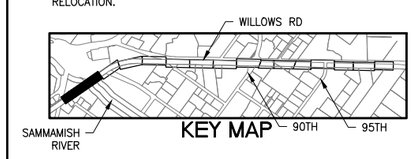

KEY MAP

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SHEET: 5 OF: 111
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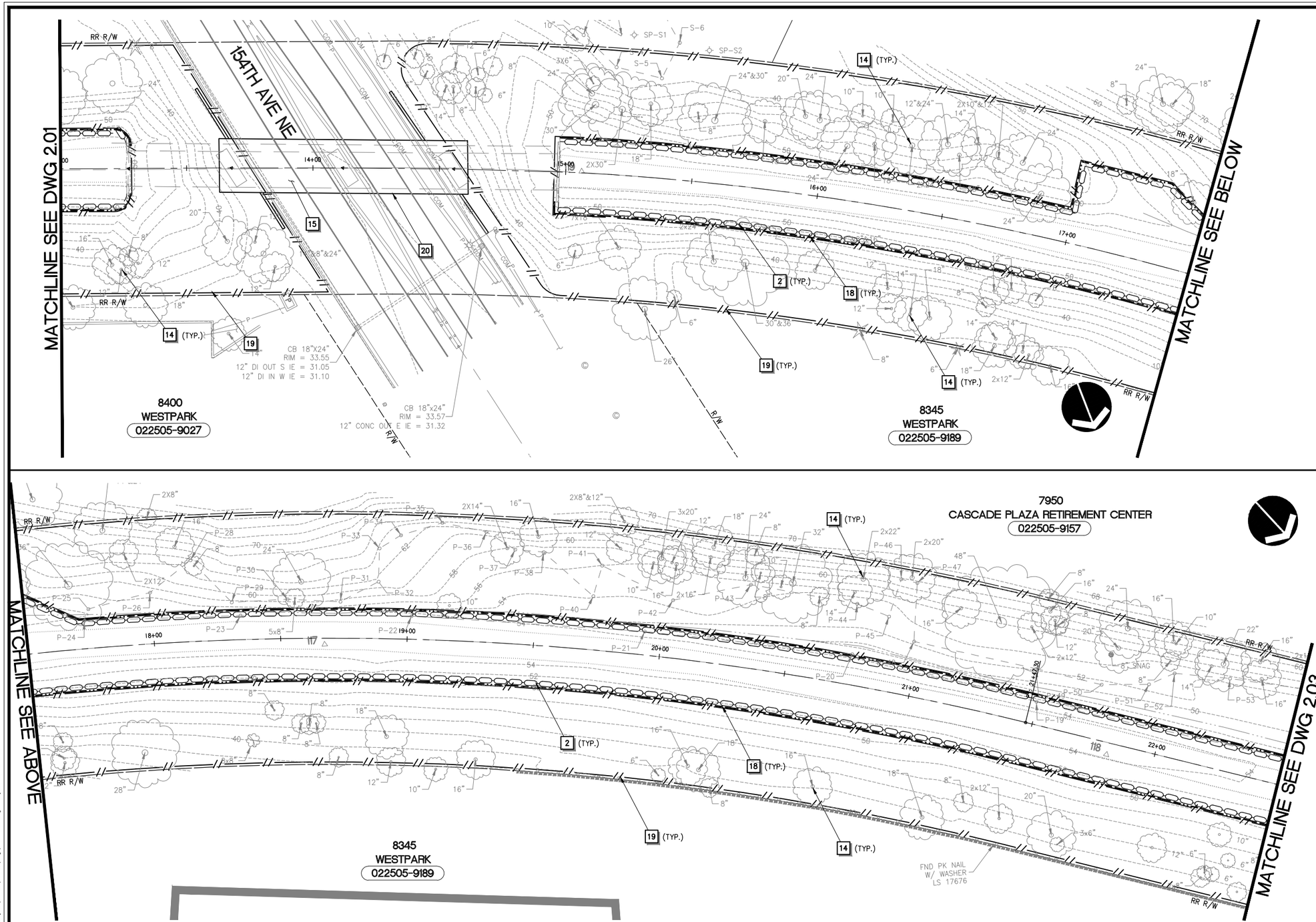

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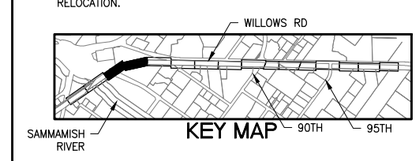

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9/30/15

TESC AND DEMOLITION PLAN

October 2015

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SHEET: 6 OF: 111
DRAWING NO. 2.02

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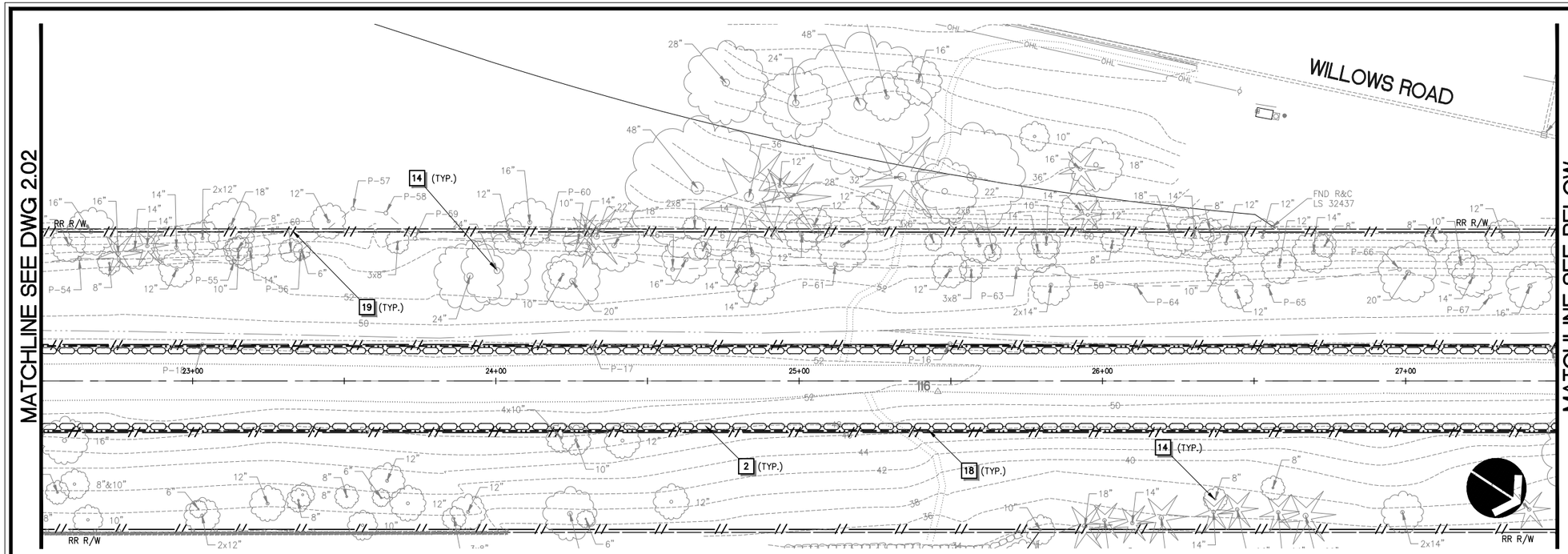

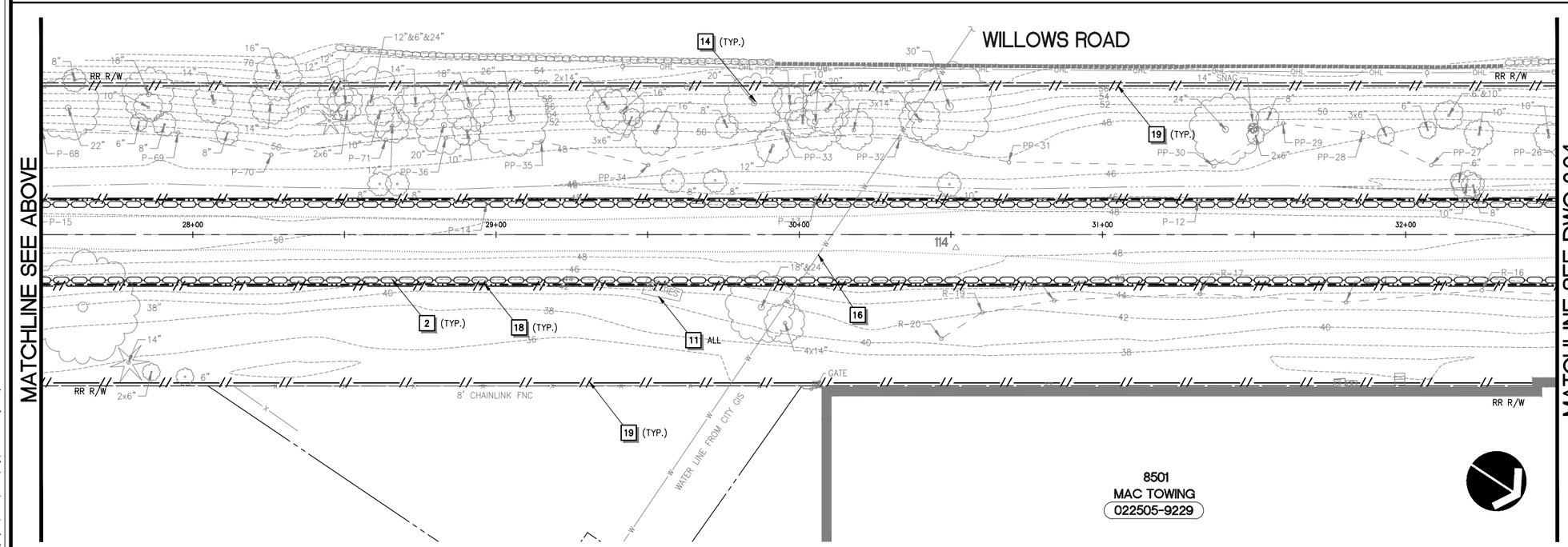

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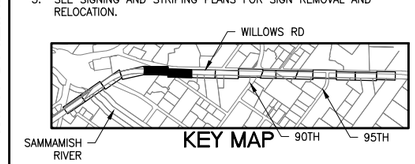

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October 2015

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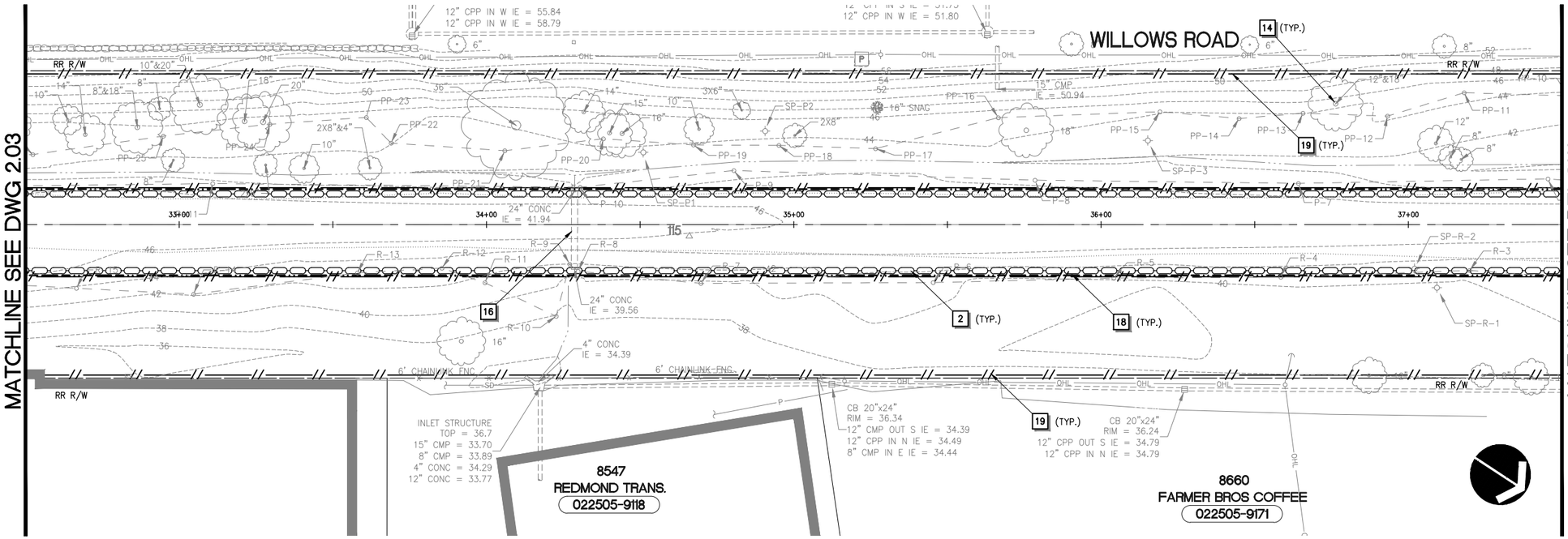

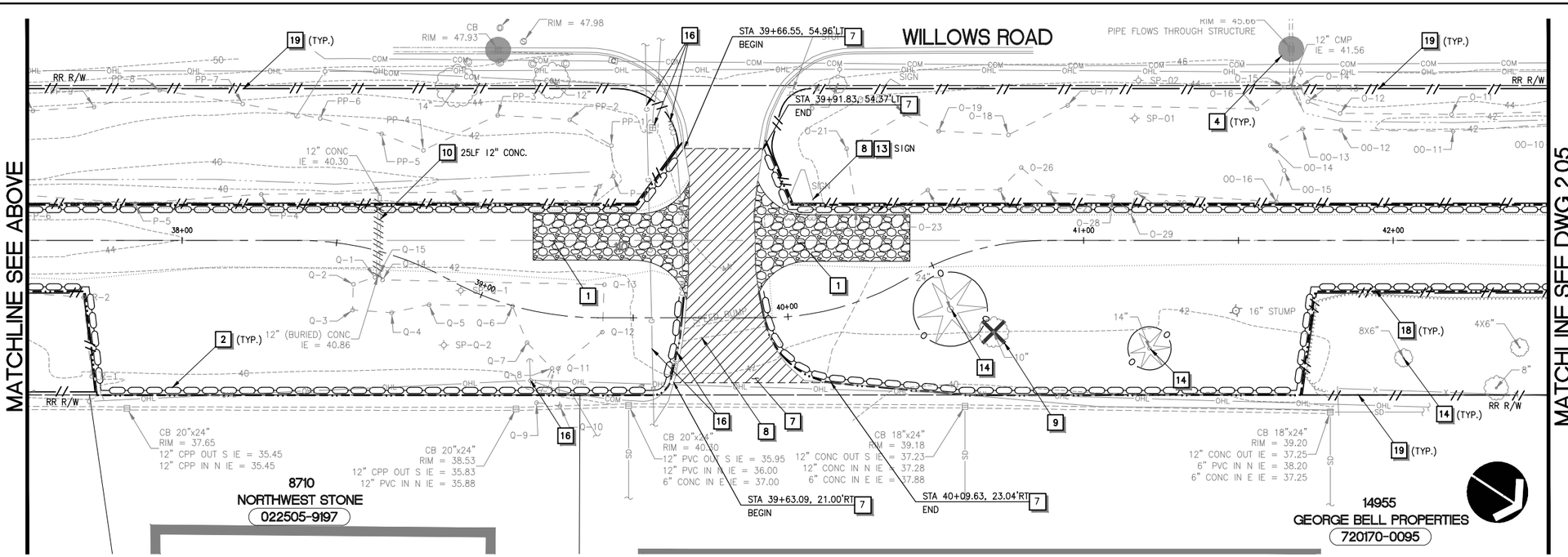

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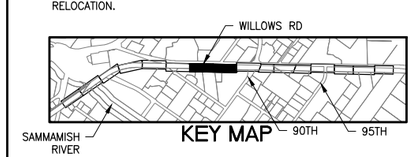

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SHEET: 8 OF: 111
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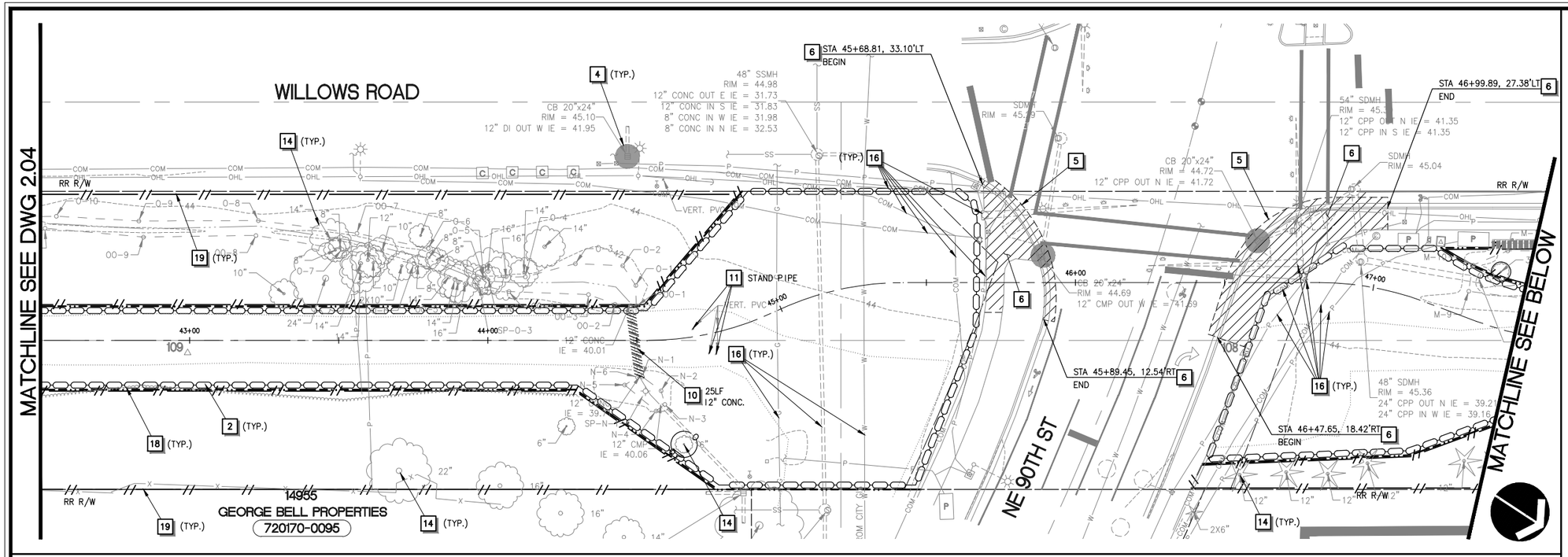

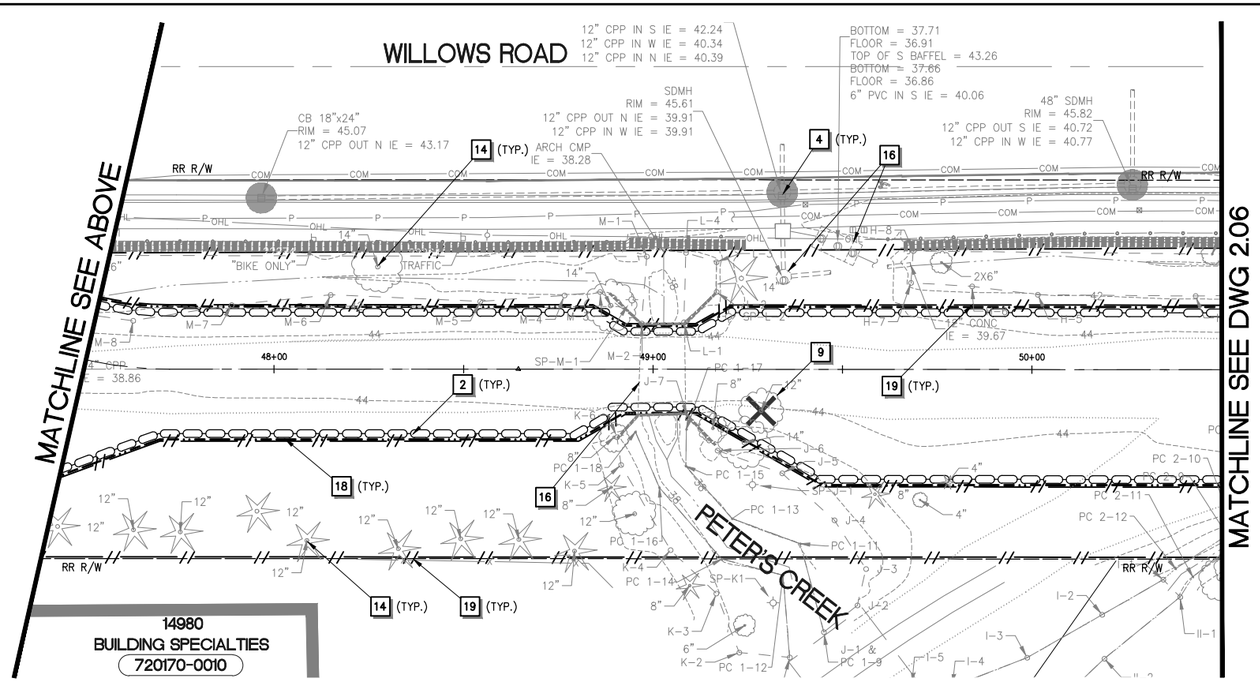

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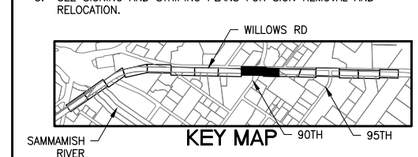

HORZ. SCALE 20' 0' 20' 40' IN FEET

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NO.	REVISION COMMENTS	BY	REVIEW	DATE

STATE OF WASHINGTON NICO M. VANDERHORST 30792 REGISTERED PROFESSIONAL ENGINEER
9/30/15

TESC AND DEMOLITION PLAN

October 2015

PROJECT NO. OTAK 32246
SHEET: 9 OF: 111
DRAWING NO. 2.05

Plotted: Oct 02, 2015 - 10:42am touta K:\project\32200\32246\Dwg\2.01-2.08.dwg Layout Name: 2.05

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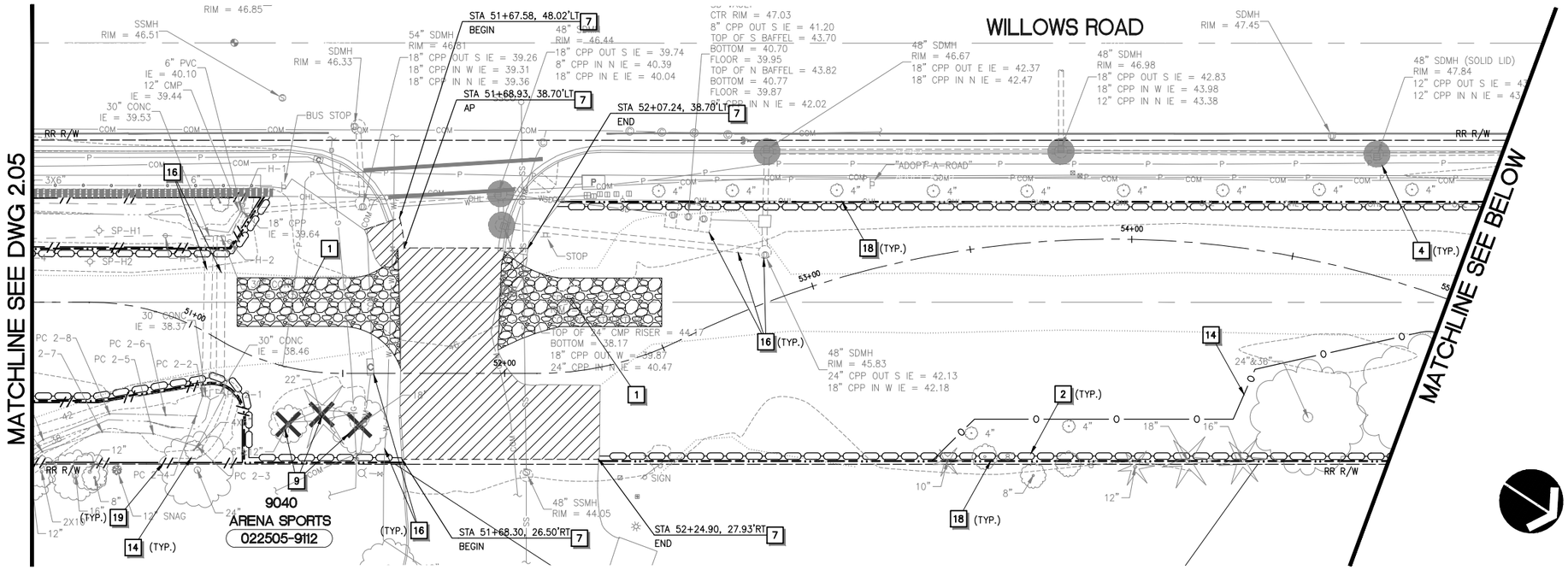

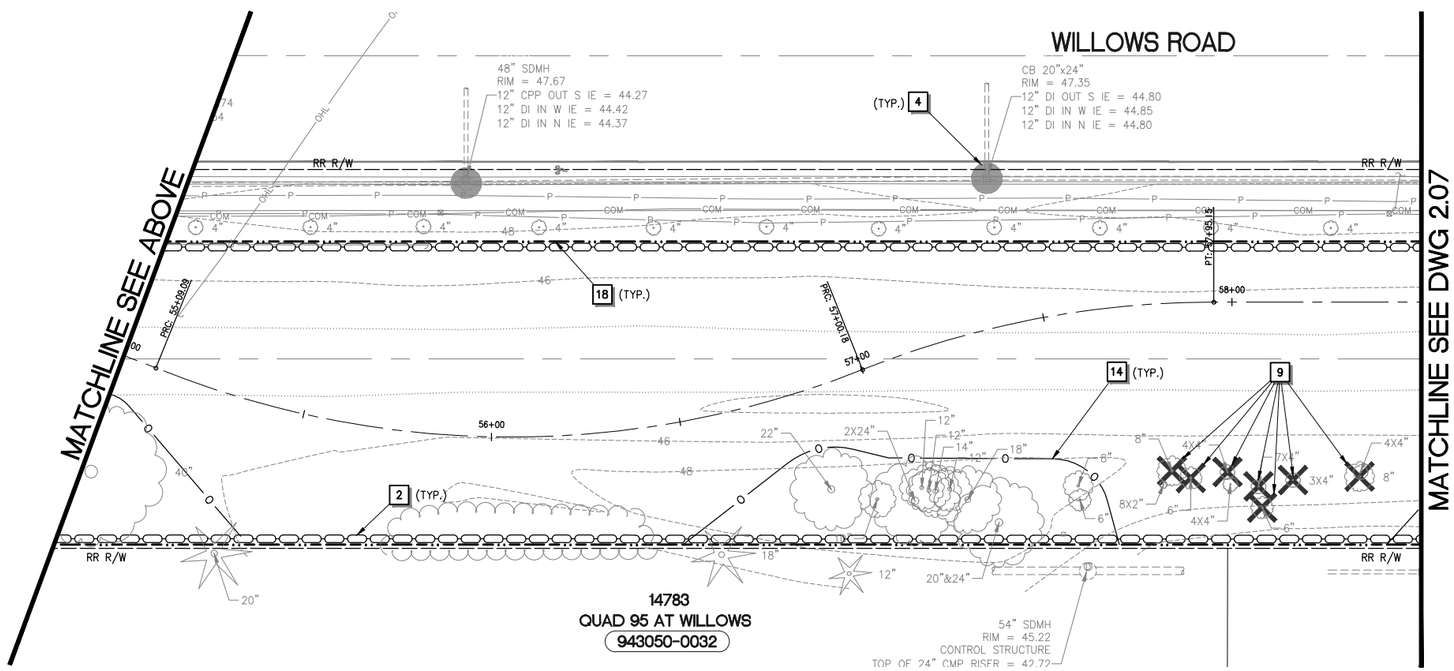

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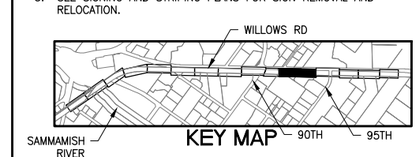

HORZ. SCALE 20' 0' 20' 40' IN FEET

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REGISTERED PROFESSIONAL ENGINEER
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TESC AND DEMOLITION PLAN

October 2015

PROJECT NO. OTAK 32246
SHEET: 10 OF: 111
DRAWING NO. 2.06

Plotted: Oct 02, 2015 - 10:42am touta K:\project\32200\32246\Dwg\2.01-2.08.dwg Layout Name: 2.06

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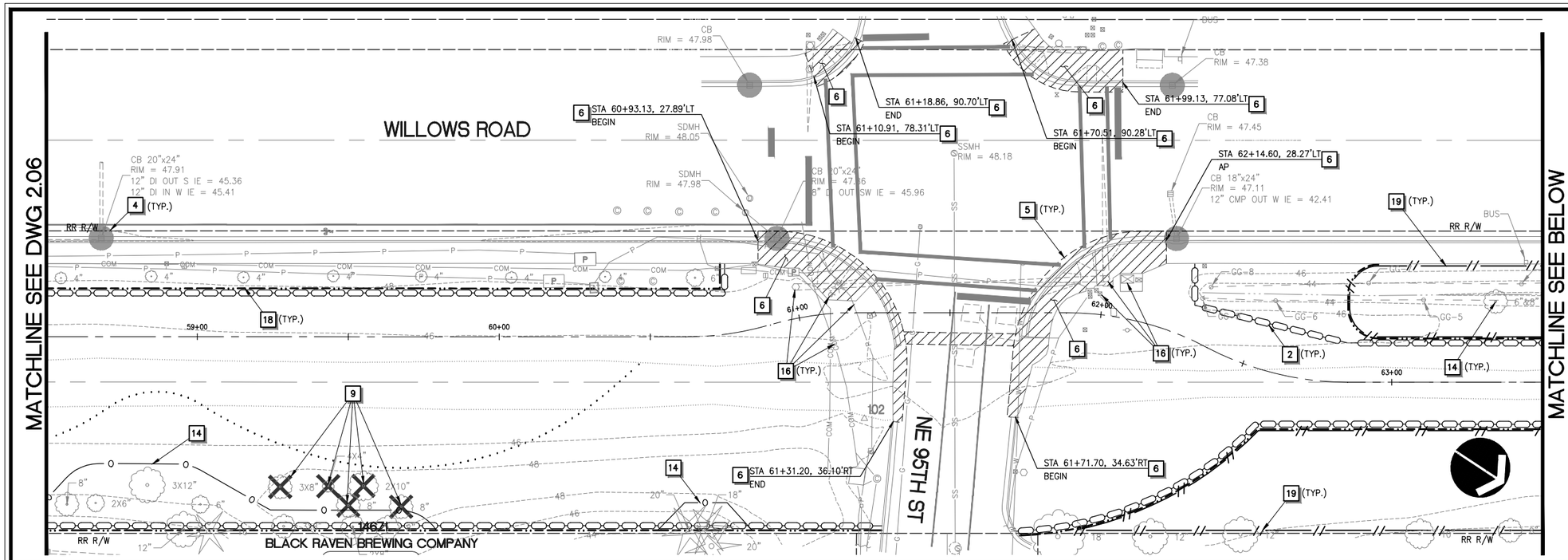

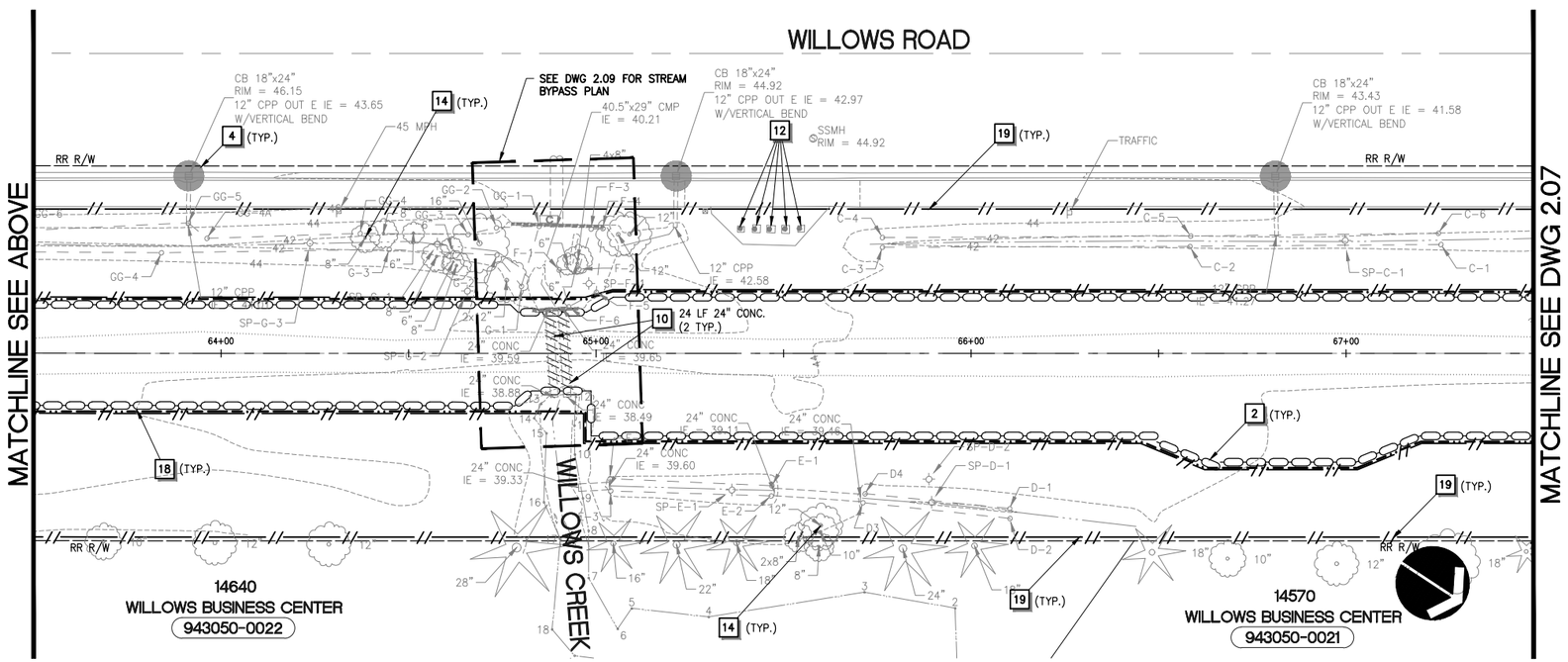

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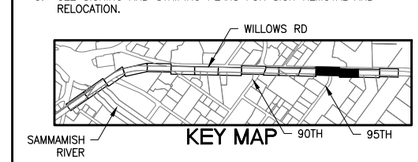

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NO.	REVISION COMMENTS	BY	REVIEW	DATE

NICO M. VANDERHORST, STATE OF WASHINGTON, 30792, REGISTERED PROFESSIONAL ENGINEER, 9/30/15

TESC AND DEMOLITION PLAN

October 2015

PROJECT NO. OTAK 32246
SHEET: 11 OF: 111
DRAWING NO. 2.07

Plotted: Oct 02, 2015 - 10:42am touta K:\project\32200\32246\Dwg\2.01-2.08.dwg Layout Name: 2.07

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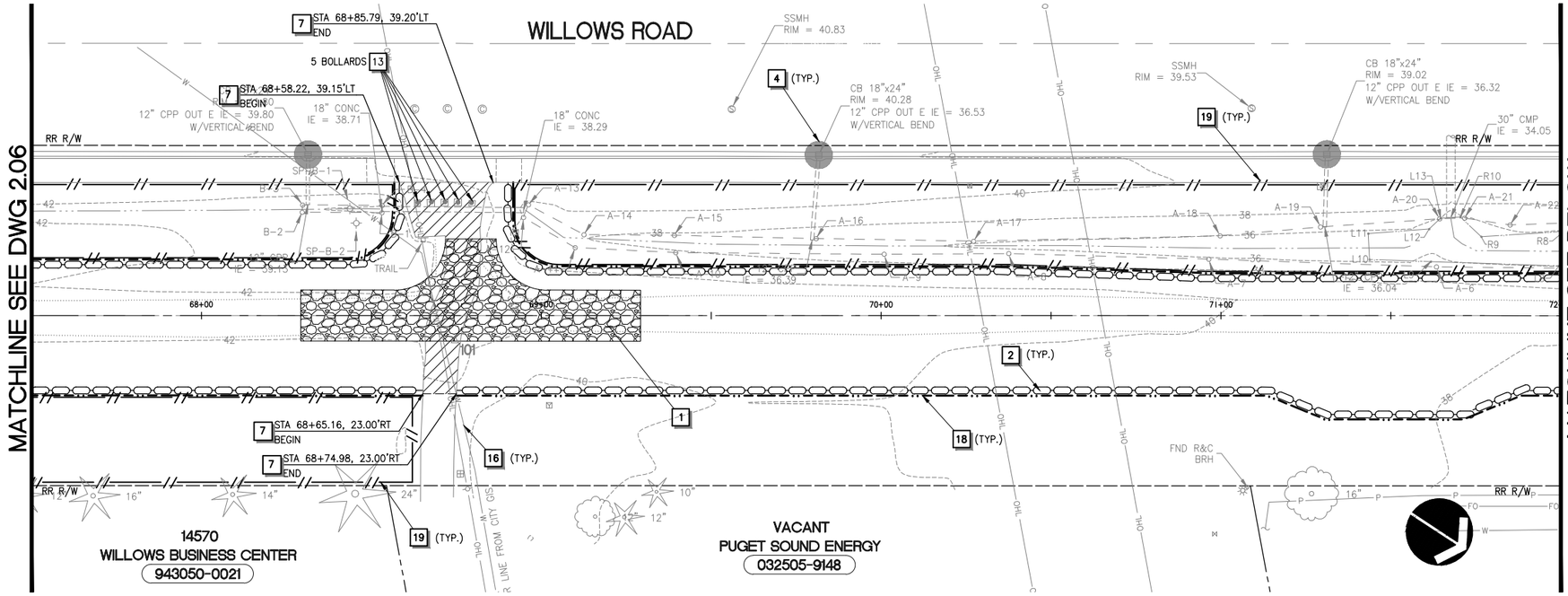

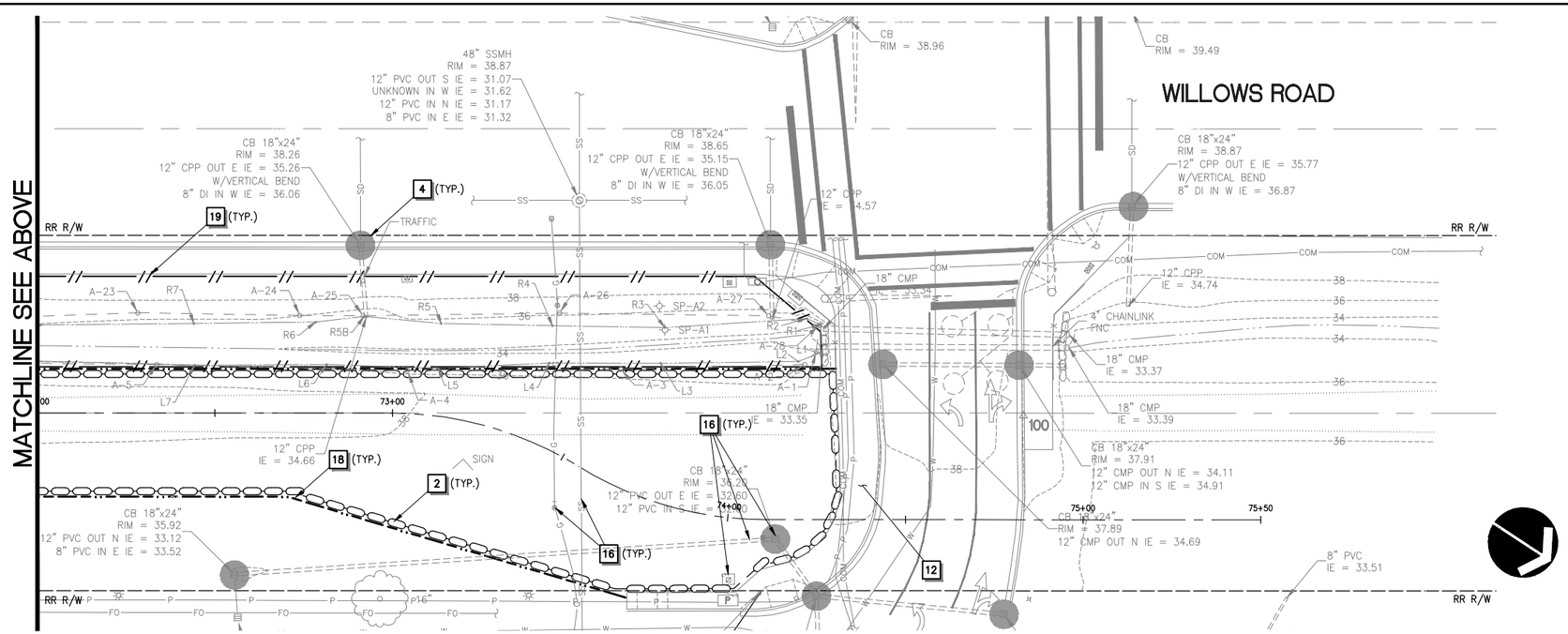

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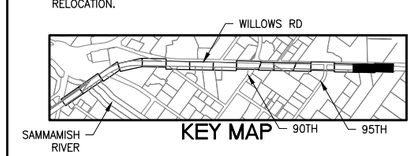

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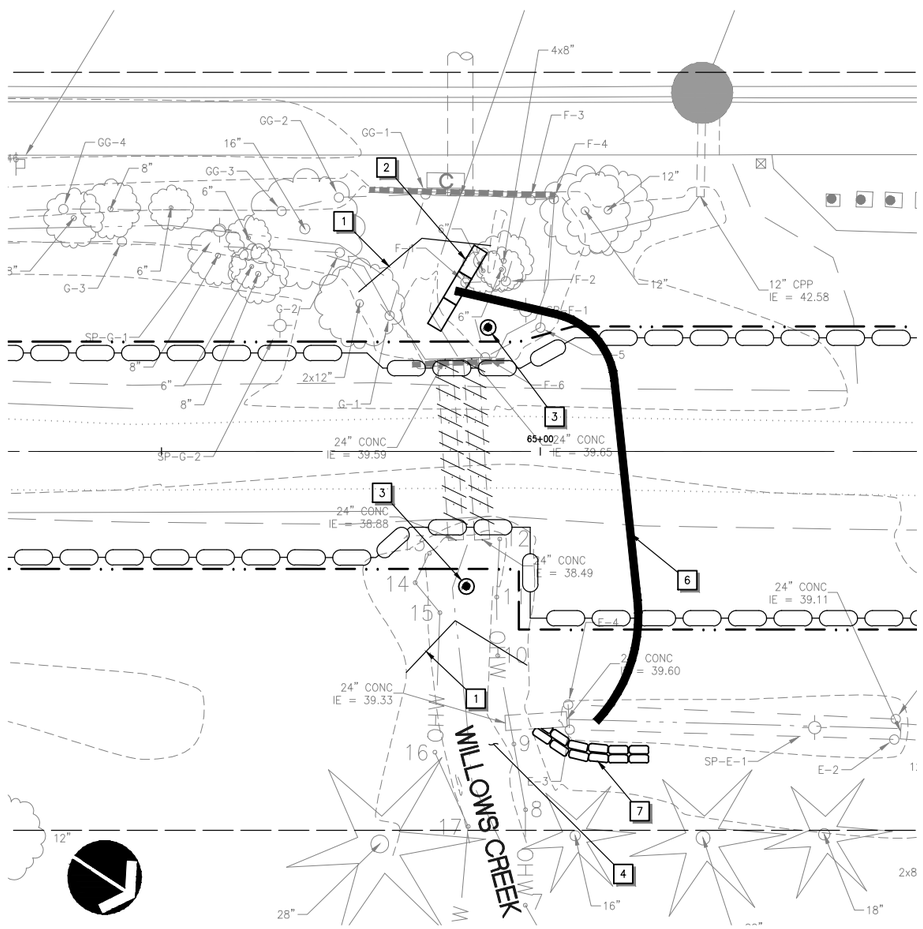
TESC AND DEMOLITION PLAN

October 2015

PROJECT NO. OTAK 32246
SHEET: 12 OF: 111
DRAWING NO. 2.08

Plotted: Oct 02, 2015 - 10:43am toula K:\project\32200\32246\Dwg\2.01-2.08.dwg Layout Name: 2.08



TTEMPORARY STREAM BYPASS PLAN

SCALE: 1"=10'

STREAM BYPASS NOTES

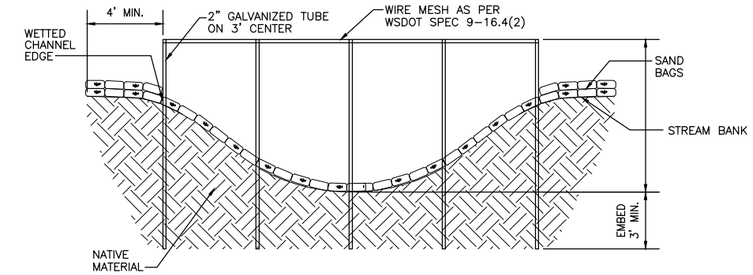
1. INSTALL FISH SCREEN. SEE DETAIL THIS SHEET.
2. INSTALL STREAM BYPASS BERM PER DETAIL THIS SHEET.
3. DEWATERING WELL, LOCATION SHALL BE FIELD VERIFIED. SEE PROJECT GEOTECHNICAL REPORT FOR REQUIREMENTS. DEWATERING WATER SHALL BE DISCHARGED THROUGH SEDIMENTATION FILTER BAG OR SETTLING TANK.
4. LIMITED ACCESS AREA. MINIMIZE DISTURBANCE TO STREAM BANK VEGETATION.
5. 3' HIGH SAND BAG BERM. WRAP SANDBAGS IN PLASTIC SHEETING AND KEY INTO STREAMBED APPROX. 6".
6. INSTALL TEMPORARY STREAM BYPASS SYSTEM. BYPASS SYSTEM SHALL BE SIZED TO ACCOMMODATE FLOWS. BRACE AS NEEDED TO RESIST THRUST FORCES AT BENDS. ANTICIPATED FLOWS ARE AS FOLLOWS:
   2YR: 9,875 gpm
   10YR: 23,340 gpm
   25YR: 26,030 gpm
   100YR: 29,170 gpm
7. BYPASS DISCHARGE, LOCATION TO BE FIELD VERIFIED. INSTALL ADDITIONAL SANDBAGS AS NECESSARY TO PREVENT EROSION AT PIPE OUTFALL.

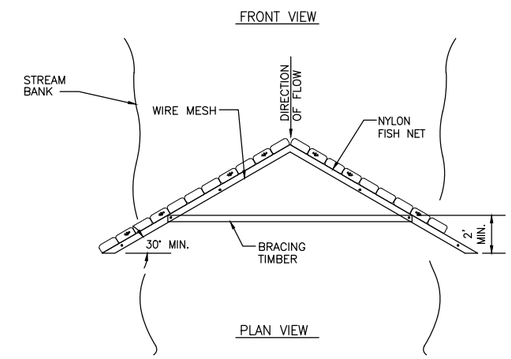
RECOMMENDED BYPASS SEQUENCING

1. INSTALL FISH SCREENS AND REMOVE FISH.
2. ISOLATE WORK AREA WITH BERMS AND INSTALL BYPASS PIPING AND PUMPS.
3. INSTALL TEMPORARY DEWATERING AS NECESSARY.
4. ADJUST TEMPORARY BYPASS AS NECESSARY TO CONSTRUCT FOOTING AND CULVERT.
5. AFTER COMPLETION OF CULVERT INSTALLATION, SLOWLY REINTRODUCE FLOW TO WORK ZONE AS SPECIFIED IN SECTION 8-27 OF SPECIFICATIONS.

GENERAL TESC NOTES

1. ALL TREES SHALL BE PROTECTED UNLESS NOTED OTHERWISE. SEE TESC PLAN FOR ADDITIONAL REQUIREMENTS.



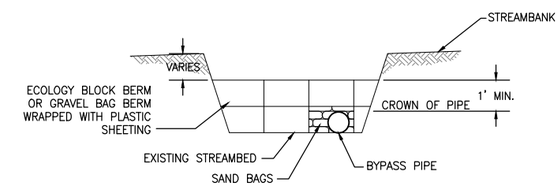


CONSTRUCTION SEQUENCE

1. INSTALL 2" GALVANIZED TUBES ON 3' CENTERS.
2. SECURE WIRE MEST TO 2" GALVANIZED TUBES WITH WIRE FASTENER.
3. SECURE ¼" MAX. GAP NYLON FISH NET TO UPSTRAM SIDE OF WIRE MESH WITH WIRE FASTENER.
4. SECURE NYLON FISH NET TO STREAM BOTTOM WITH SAND BAGS.
5. EXTEND SAND BAGS 4' MIN. BEYOND WETTED EDGE OF STREAM.
6. ADD BRACING TIMBER AS NEEDED TO SUPPORT THE NET.
7. REMOVAL OF DEBRIS FROM THE UPSTREAM SIDE OF THE FENCE IS NECESSARY OTHERWISE THE SCREEN WILL BECOME CLOGGED AND WATER MAY TOPPLE OR BREACH THE SCREEN.

FISH SCREEN DETAIL

NOT TO SCALE



TEMPORARY STREAM BYPASS BERM DETAIL

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DESIGN ENGR.	DRAWN	CHECKED
TP/SW	AK/EW	NV/DS

NO.	REVISION COMMENTS	BY	REVIEW	DATE

NICO M. VANDERHORST
STATE OF WASHINGTON
30792
REGISTERED PROFESSIONAL ENGINEER
9/30/15

TEMPORARY STREAM BYPASS

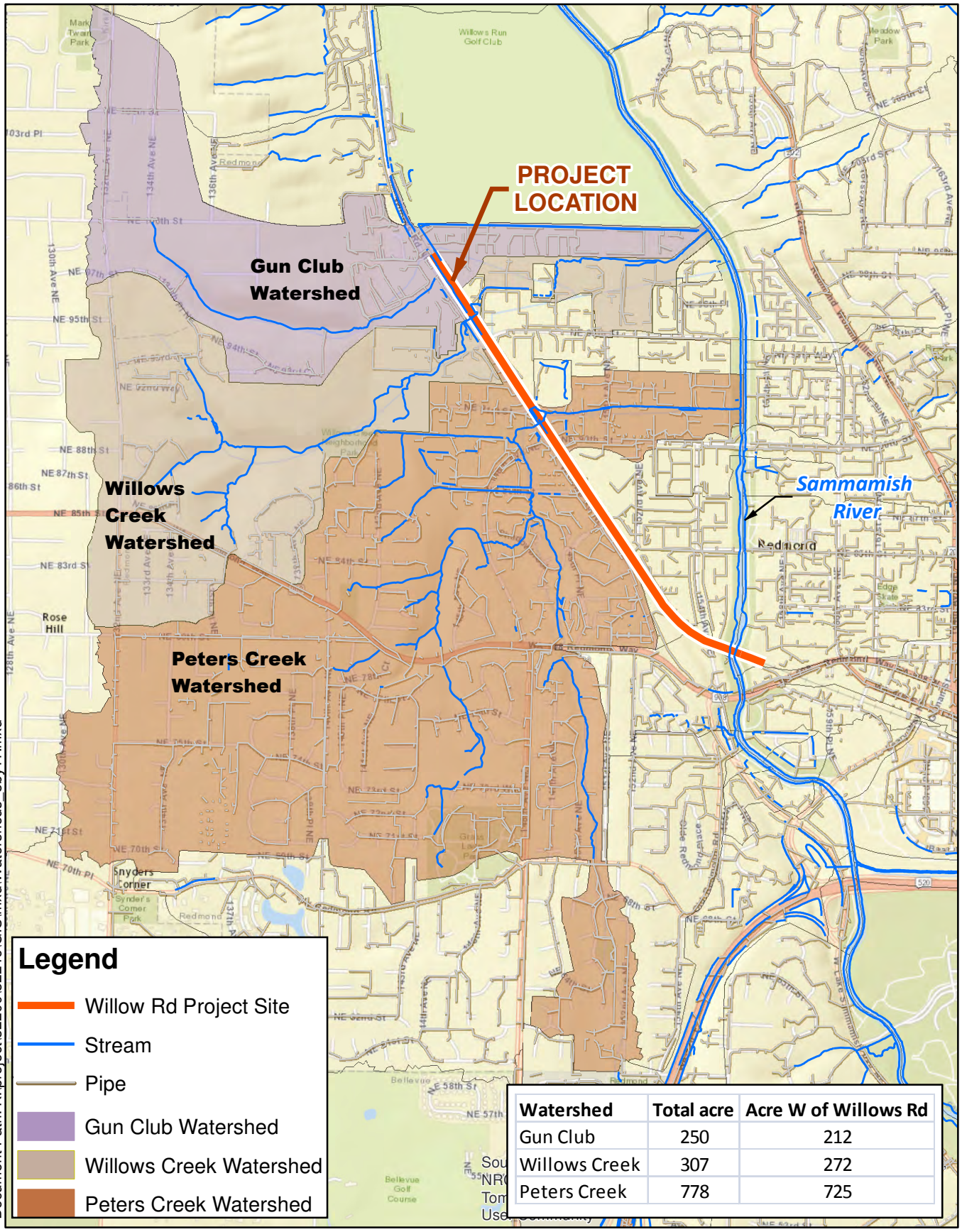
October 2015

PROJECT NO.
OTAK 32246

SHEET: 13 OF: 111

DRAWING NO.
2.09

Plotted: Oct 02, 2015 - 10:43am touia K:\project\32200\32246\Dwg\2.09.dwg Layout Name: 2.09



Watershed	Total acre	Acre W of Willows Rd
Gun Club	250	212
Willows Creek	307	272
Peters Creek	778	725

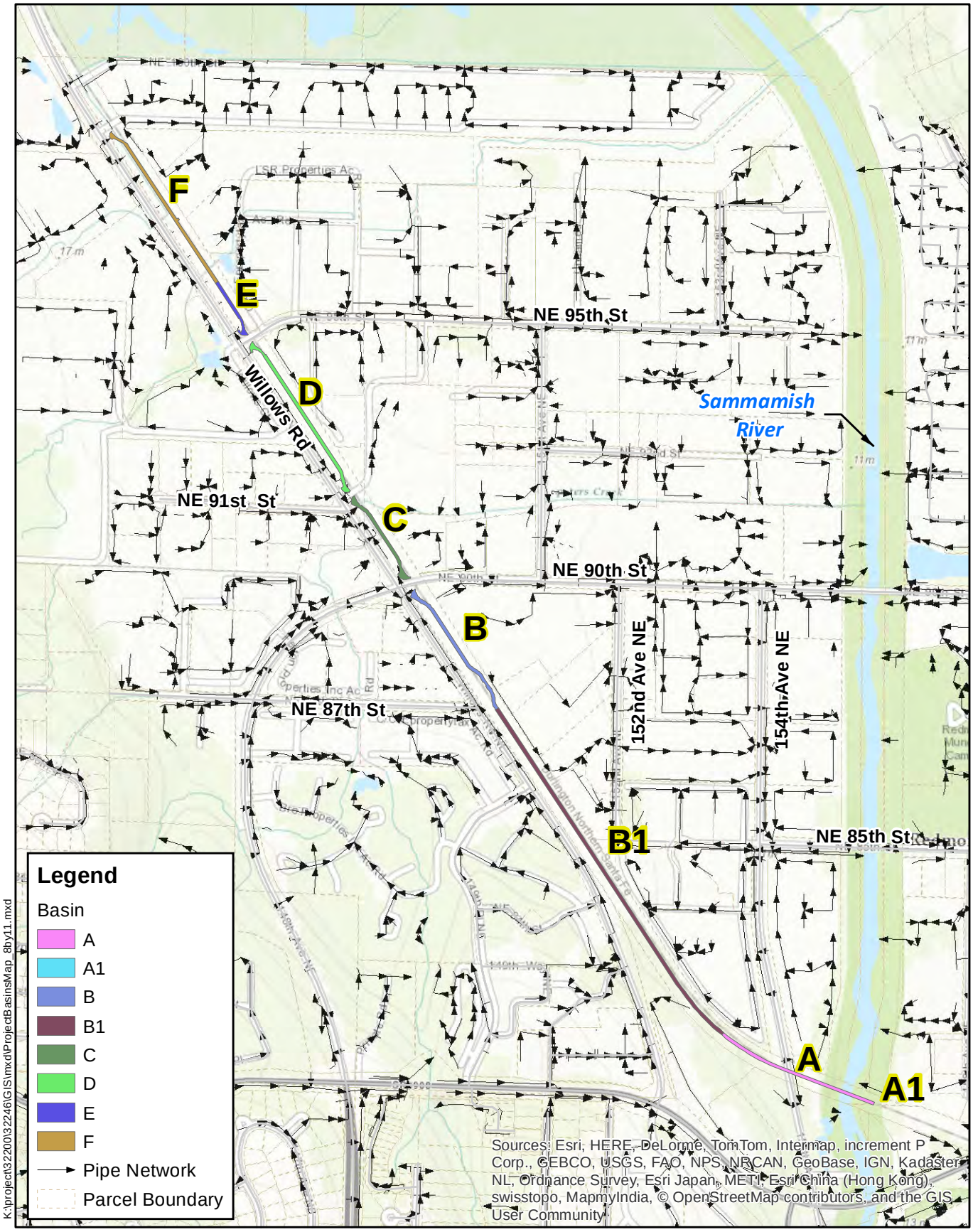
Document Path: K:\project\32200\32246\GIS\mxd\Watersheds_8by11.mxd

Figure 3
Watershed Map

Date: 1/22/2015

0 0.25 0.5 Miles

Redmond Central Connector - Phase 2



K:\project32200\32246\GIS\mxd\ProjectBasinsMap_8by11.mxd

Figure 4
Project Basins Map

Date: 1/20/2015

0 350 700 Feet

Redmond Central Connector - Phase 2

Appendix H — Contract Drawings

(Under Separate Cover)